1

Lateral Hip & Buttock Pain
Contemporary Diagnostic & Management Strategies
Introduction

Module 1 – Lesson 1

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Potential sources of nociception in the lateral hip & buttock

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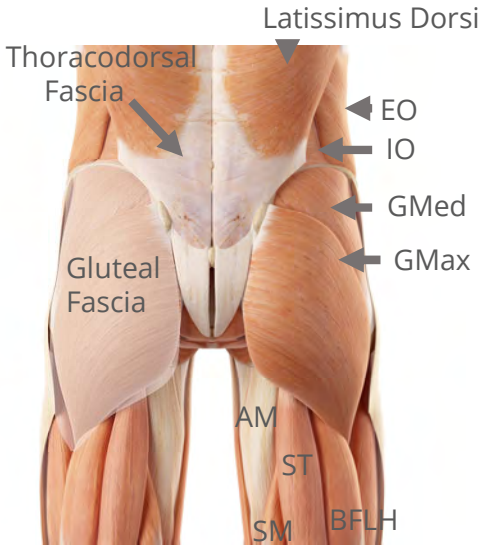
Myofascial Structures



EO:External Oblique; IO:Internal Oblique; GMed:Gluteus Medius; GMax:Gluteus Maximus; AM:Adductor Magnus; SM:Semimembranosis; ST:Semitendinosis; BFLH:Biceps Femoris Long Head; TFL: Tensor Fascia Lata; ITB:Iliotibial Band

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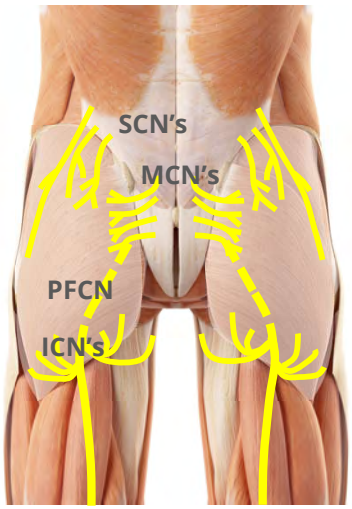
Superficial Nerves



SCN's: Superior Cluneal Nerves
MCN's: Middle Cluneal Nerves
ICN's: Inferior Cluneal Nerves
PFCN: Posterior Femoral Cutaneous Nerve
IHGN: Iliohypogastric Nerve
SubCN: Subcostal nerve

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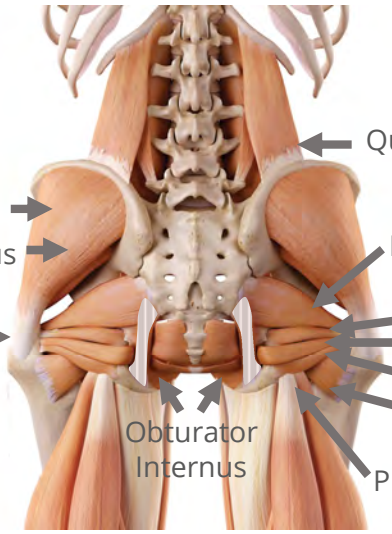
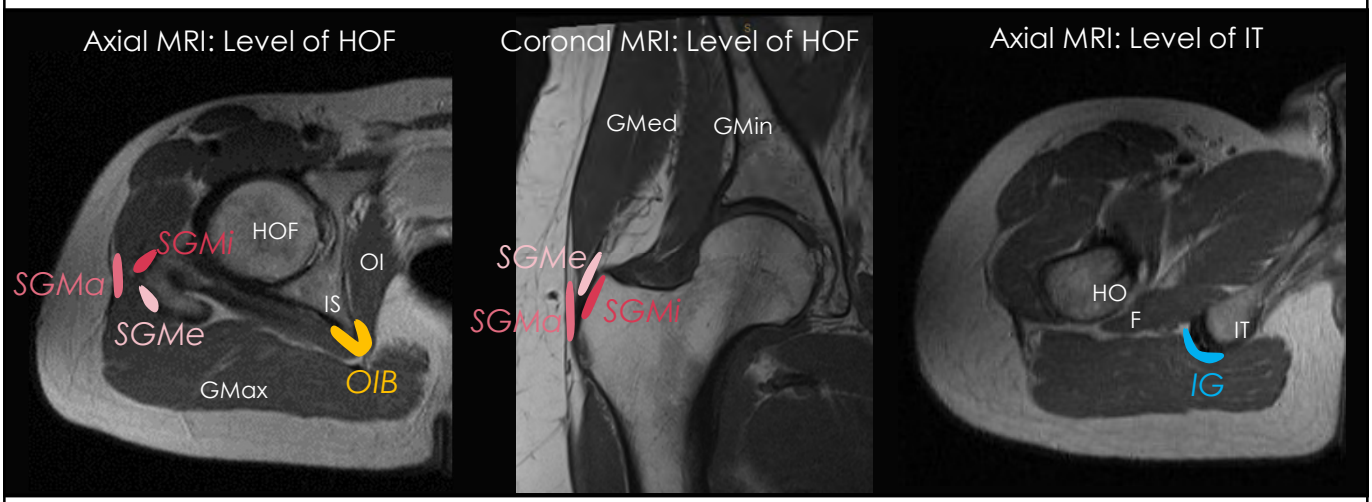
Deeper posterolateral musculotendinous structures



Quadratus Lumborum
Gluteus Medius
Gluteus Minimus
Piriformis
Gluteus Medius & Minimus Tendons
Superior Gemellus
Obturator Internus
Inferior Gemellus
Quadratus femoris
Obturator Internus
Proximal hamstring tendons

6

Major Bursae of the Lateral Hip & Buttock



SGMa: Subgluteus Maximus (Trochanteric) Bursa; ***SGMe: Subgluteus Medius Bursa;***
SGMi: Subgluteus Minimus Bursa; ***OIB: Obturator Internus Bursa;*** ***IG: Ischiogluteal Bursa***

HOF: Head of Femur; IS: Ischial Spine; IT: Ischial Tuberosity; OI: Obturator Internus; GMax: Gluteus Maximus; GMed: Gluteus Medius; GMin: Gluteus Minimus

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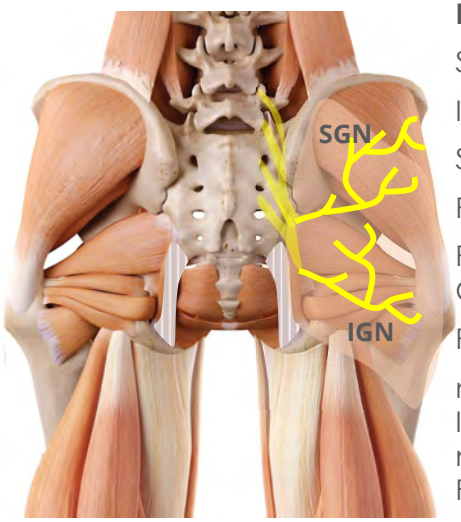
Deeper Nerves



Nerves:

SGN: Superior Gluteal

IGN: Inferior Gluteal

SN: Sciatic

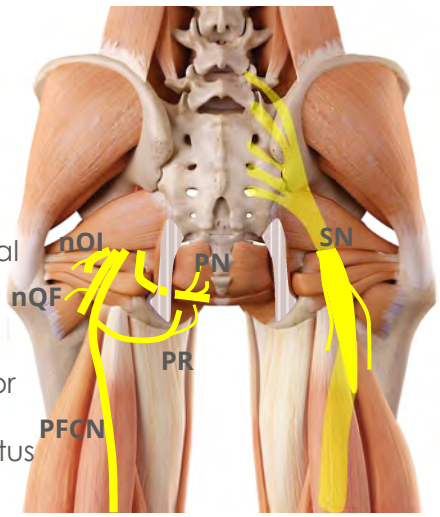
PN: Pudendal

PFCN: Posterior Femoral Cutaneous

PR: Perineal Ramus

nOI: nerve to Obturator Internus

nQF: nerve to Quadratus Femoris



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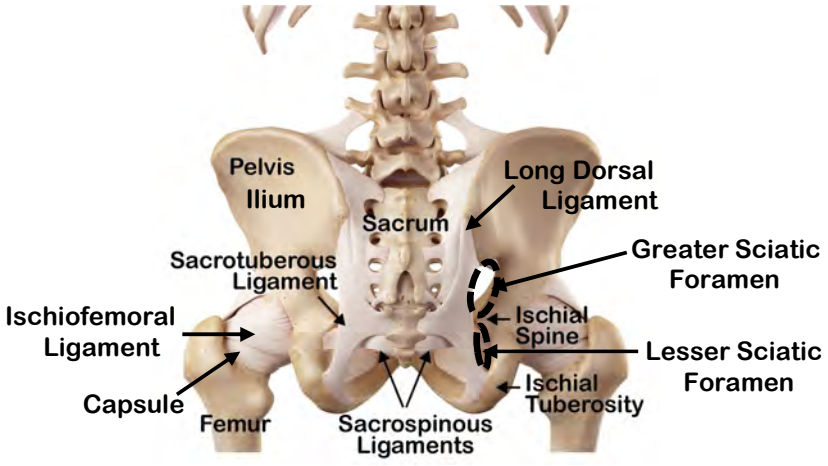
Bones & Capsuloligamentous Structures



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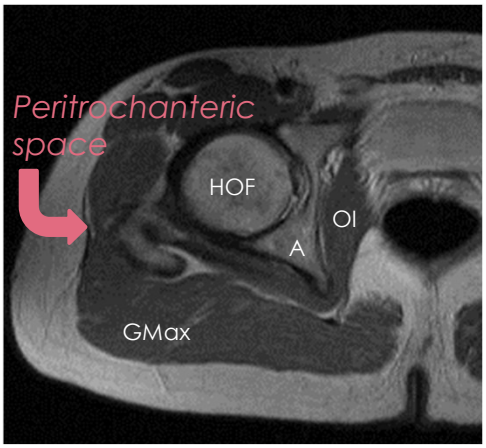
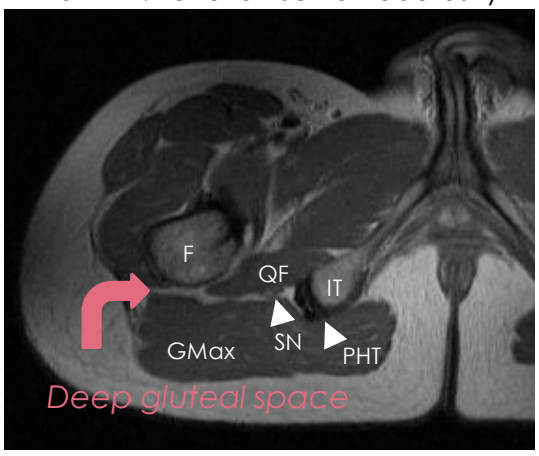
The Peritrochanteric & Deep Gluteal Spaces

Axial MRI: Level of HOF



Axial MRI: Level of Ischial Tuberosity



GMax: Gluteus Maximus; Piri:Pififormis; HOF: Head of Femur; A: Acetabular column; OI: Obturator Internus; QF: Quadratus Femoris; F: Femur; IT:Ischial Tuberosity; SN: Sciatic Nerve; PHT: Proximal Hamstring Tendons

Byrd 2015

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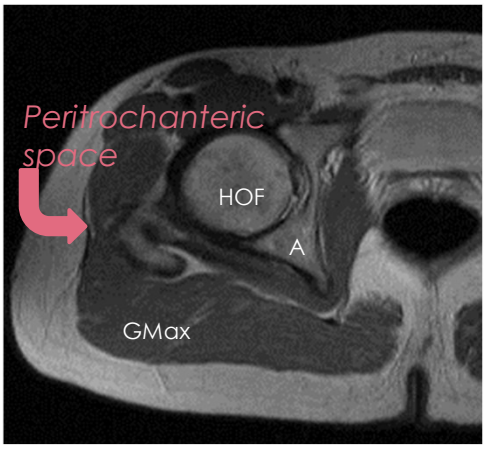
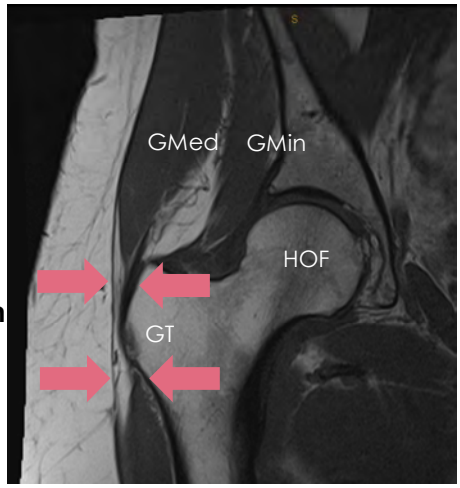
The Peritrochanteric Space

Axial MRI: Level of HOF



Coronal MRI: Level of HOF



Between ITB & GT

GMax: Gluteus Maximus; HOF: Head of Femur; A: Acetabular column; GT:Greater Trochanter; GMed: Gluteus Medius; GMin: Gluteus Minimus

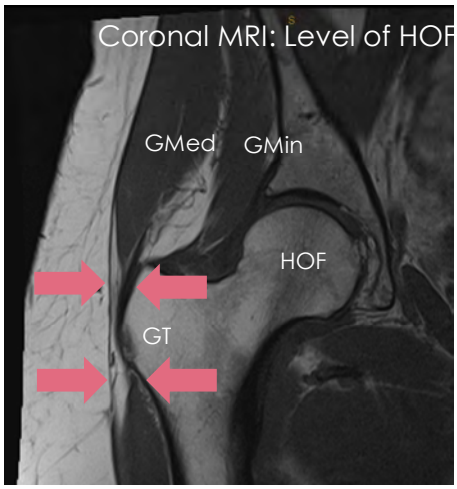
Byrd 2015

Contents of the Peritrochanteric Space

Muscles/Tendons/Bursae:

- *Tendinous insertions of Gluteus Medius & Minimus*
- Origin of vastus lateralis
- Subgluteus maximus (trochanteric) bursa
- Subgluteus medius bursa
- Subgluteus minimus bursa

Coronal MRI: Level of HOF

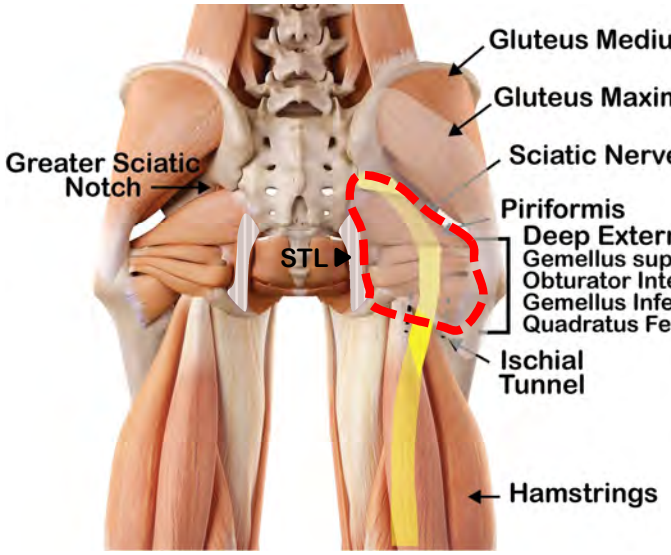


Between ITB & GT

GMax: Gluteus Maximus; HOF: Head of Femur; A: Acetabular column; GT:Greater Trochanter; GMed: Gluteus Medius; GMin: Gluteus Minimus

Byrd 2015

The Deep Gluteal Space



Borders of the deep gluteal space:
Superiorly: greater sciatic notch
Inferiorly: distal ischium
Laterally: gluteal tuberosity of femur
Medially: sacrotuberous ligament

Martin et al 2015

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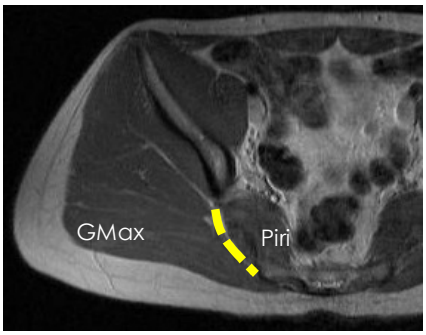
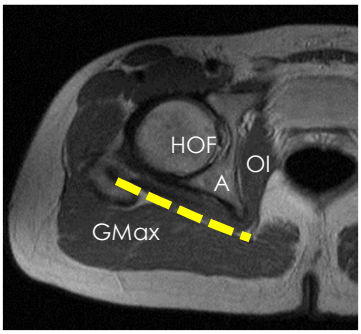
The Deep Gluteal Space

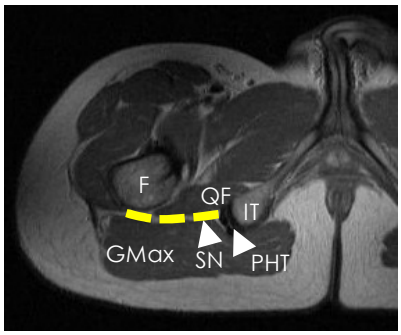
Axial MRI: Level of GSNotch



Axial MRI: Level of HOF



Axial MRI: Level of ITuberosity



Borders of the deep gluteal space:
Posteriorly: gluteus maximus
Anteriorly: posterior acetabular column, hip capsule & proximal femur

GMax: Gluteus Maximus; Piri:Pififormis; HOF: Head of Femur; A: Acetabular column; OI: Obturator Internus; QF: Quadratus Femoris; F: Femur; IT:Ischial Tuberosity; SN: Sciatic Nerve; PHT: Proximal Hamstring Tendons

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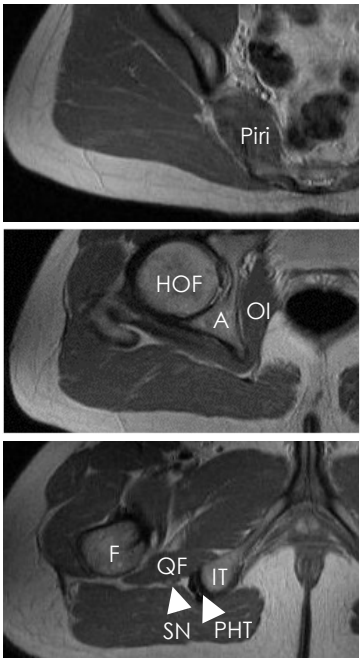
Contents of the Deep Gluteal Space

Muscles/Tendons/Bursae:
Piriformis
Obturator Internus & Gemelli & bursa
Quadratus Femoris
Proximal Hamstring Tendons & Ischiogluteal bursa



The Deep Gluteal Space

Neurovascular structures:
Sciatic Nerve (SN)

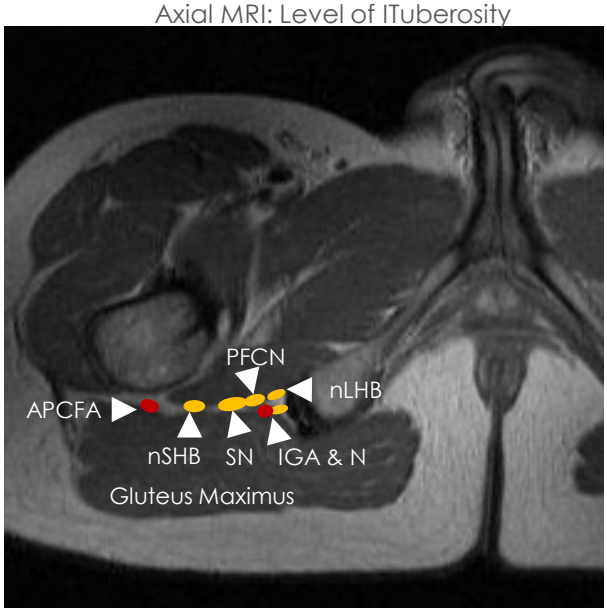
Posterior Femoral Cutaneous Nerve (PFCN)

Nerves to short & long heads of Biceps Femoris (nSHB; nLHB)

Inferior Gluteal Artery & Nerve

Ascending posterior circumflex femoral artery (APCFA)

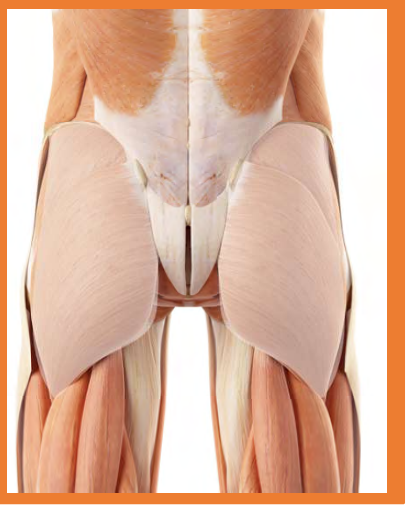
Axial MRI: Level of ITuberosity



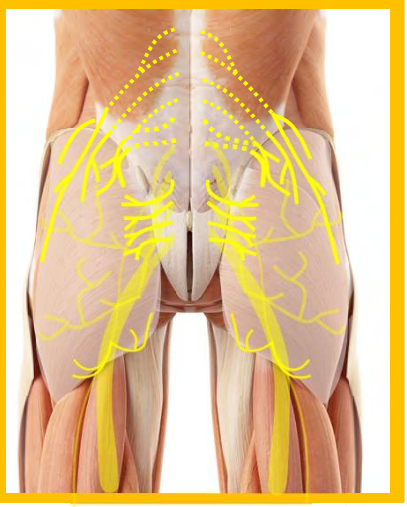
Focus Modules

Joint Related Pain & Bony Impingements

Soft Tissue Related Pain
Muscle, Fascia, Tendon, Bursa



Referred & Nerve Related Pain



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Joint Related Pain & Bony Impingements

LATERAL HIP & BUTTOCK PAIN Joint Related Pain & Bony Impingements

Module 1 – Lesson 2

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Joint Related Pain & Bony Impingements

WHAT? → **Sources of Nociception**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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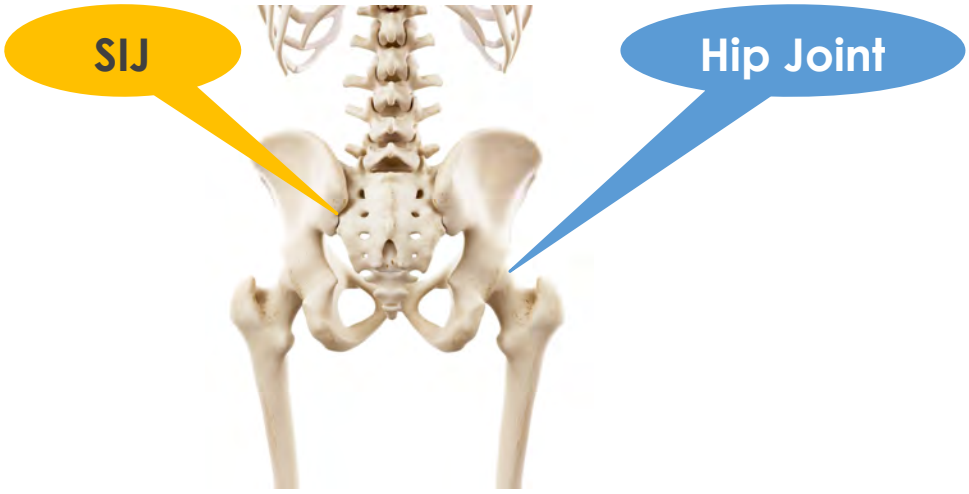
Joint Related Lateral Hip & Buttock Pain



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Joint Related Lateral Hip & Buttock Pain

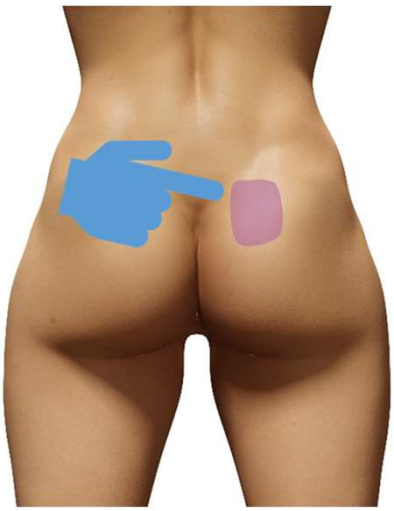
SIJ Related Pain

- Fortin's Finger Test
- Pain in PSIS region

85% relieved with SIJ injection

Of those,
pain relieved by:

periarticular LAI in 81%
intra-articular LAI in 19%



Fortin et al 1994, Fortin & Falco 1997, Murakami et al 2018

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Joint Related Lateral Hip & Buttock Pain

Regardless of your beliefs, don't ignore the SIJ as a source of nociception

Fortin et al 1994, Fortin & Falco 1997, Murakami et al 2018

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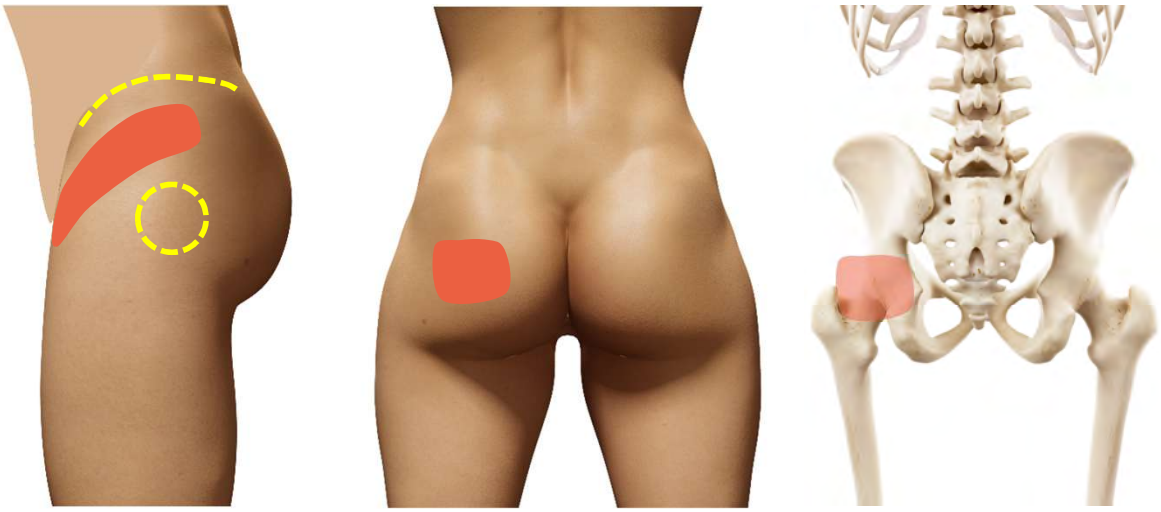
Joint Related Lateral Hip & Buttock Pain

Hip Joint Related Pain



Khan et al 2004, Battaglia et al 2016

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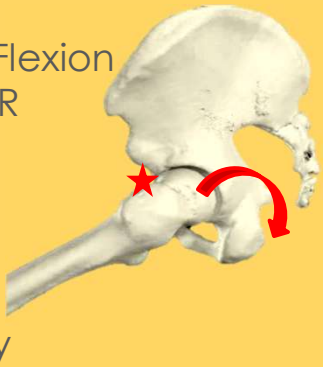
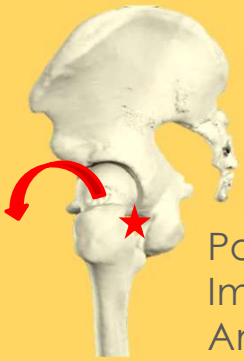
The Interplay between Impingement & Instability

In Flexion & IR



Anterior Impingement & Posterior Instability



In Extension & ER

Posterior Impingement & Anterior Instability

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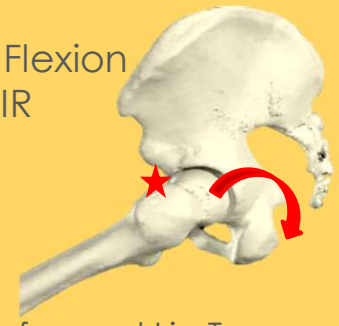
Posterior Hip Instability

In Flexion & IR



Ischiofemoral Lig Tear
Labral tear
Bony rim #

Mechanisms

- Trauma – mva, fall onto knee
- Anterior FAI
  - ⬆ α angle, cam morphology
  - ⬇ acet anteversion & post coverage
  - ⬇ femoral version (retroversion)
- AIIS/Subspine Impingement
- Supraphysiological movements
- Iatrogenic – open surgical procedure
- Global Laxity

Canham et al 2016, Charbonnier et al 2010, Mayer et al 2016, Novais et al 2018, Steppacher et al 2013,Upadhyay et al 1985, Wassilew et al 2016

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Clinical Indicators of Posterior Instability

Interview Features: Posterior &/or anterior hip pain

Pt may report clicking, popping, lack of confidence in leg
Bending/lifting/sit-stand, WB IR, impact, walk uphill/stairs, sit knees crossed

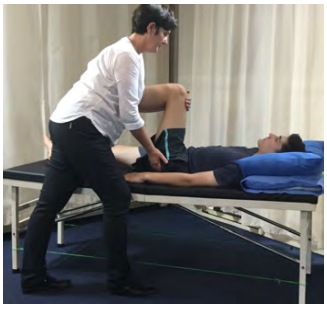
Physical Features:

Apprehension Test – apprehension in:

Hip Flexion/Add/IR with posterior glide

Prone Hip IR – may also be apprehensive

Relocation Test



Less apprehension,
Less pain , Increased ROM

Kalisvaart & Safran 2007, Maas et al 2017

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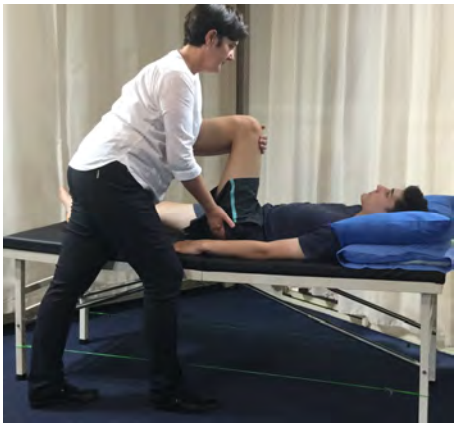
Posterior Relocation Test

Anterior translation of HOF into:

1. Hip Flexion



2. Hip Internal Rotation

Dynamic test into hip flexion & IR – increase painfree range?
* May present with ant hip pain, alleviated by anterior glide

Maas et al 2017

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MANAGEMENT OF POSTERIOR HIP INSTABILITY

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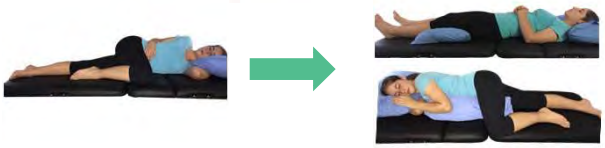
Management of the patient with hip pain & posterior instability

Load Management

- Reduce time spent in end range positions *Flexion/Adduction/IR
- Sitting – higher chairs, no knee crossing, watch fwd lean
- Sleeping – Avoid F/ADD
- Kneeling better than bending
- Listen to joint response to load – want to avoid/minimise any inflammatory processes - Night ache, morning stiffness



Extend aff side

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Management of the patient with hip pain & posterior instability

Exercise

Optimise local muscular support

- Deep, short external rotators are the priority
- Gluteus maximus as secondary support

Movement retraining & graduated loading

- Optimise femoro-pelvic control – control of F/ADD/IR – GMax, Med
- sit-stand, stairs, hills , other functional WB Tasks
  - avoid unnecessary Add/IR esp combined with hip flexion; try slightly abducted/ER positions; try gentle preset deep rotators
- Once movement control is achieved – add challenge – load, range, speed, perturbation, impact

Address individual impairments while avoiding adverse joint loads

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Exercise therapy for Posterior Instability

Isometric ER
Start in extension

Weightbearing ER
Start in extension
Add challenge - F

Abduction + ER
Graduated Challenge - F

Graduated Functional Challenge - Flexion, Load Perturbation, Speed, Impact

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Joint Related Pain & Bony Impingements

Posterior & Lateral Bony Impingement

Module 1 – Lesson 3

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Posterior Femoroacetabular Impingement

Mechanisms

Hip Actions

- Extension (including post pelvic tilt)
- External rotation
  - 83.0% between FN & acetabulum
  - 17.0% between LT & ischium
- Adduction

Bony Morphology

- Pincer or posterior cam morphology
- Coxa Valgus (more vertical neck)
- Perthes Disease
- Femoral or acetabular anteversion

In Extension, & ER

Morris et al 2018, Siebenrock et al 2013, Tannast et al 2012

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Posterior Femoroacetabular Impingement Zones

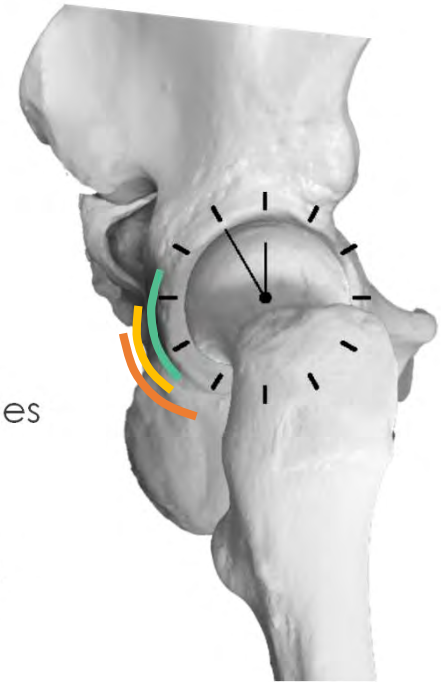
Normal Bony Shape

Pincer &/or cam morphology

- similar zones but more frequently than normal in lower zones & less in higher zones

Valgus with increased femoral anteversion or Perthes

- impingement earlier in range & in more postero-inferior regions



Siebenrock et al 2013, Tannast et al 2012

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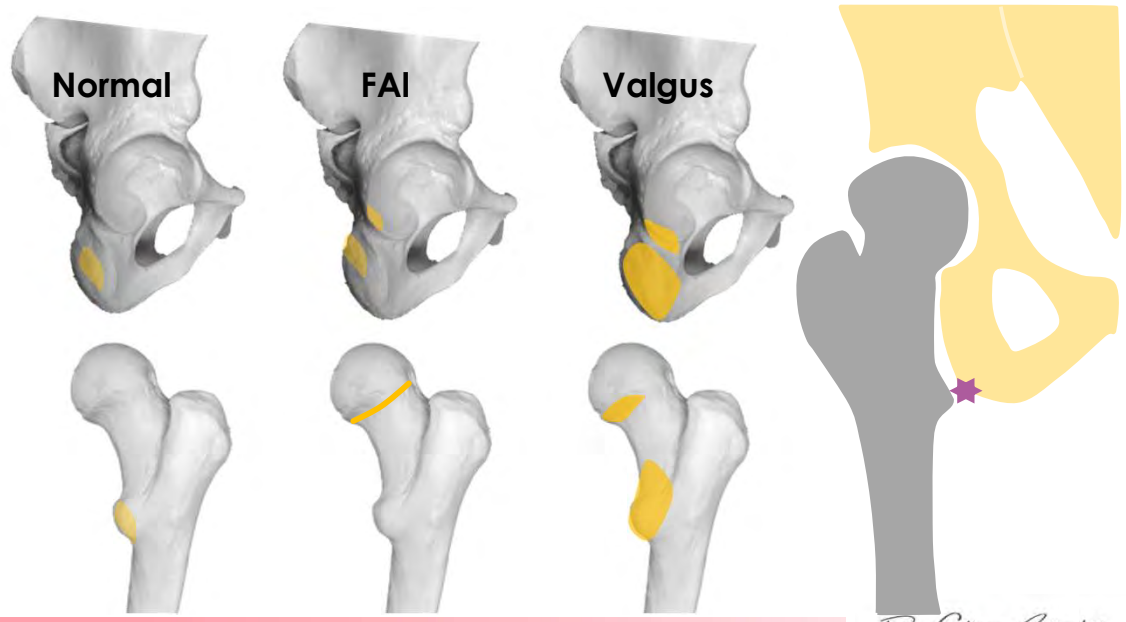
Intra & Extra-articular Posterior Collision Zones



Siebenrock et al 2013

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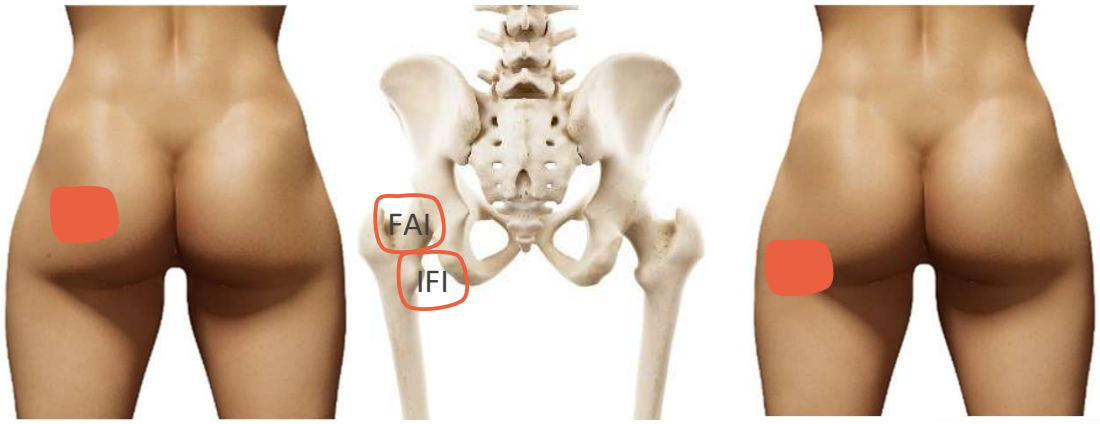
Clinical Indicators of Posterior Impingement

Interview Features:

Posterior pain associated with impingement &/or anterior hip pain(instability)
Pain exacerbated by combinations of hip extension, ER & adduction

Posterior FAI **Extra-articular Impingement - IFI**



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Clinical Indicators of Posterior Impingement

Physical Features:

Posterior Rim Impingement Test

Hip Extension/Abd/ER
+ve: Reproduction of posterior hip pain

Ischiofemoral Impingement Test

Hip Extension in adduction
+ve: Reproduction of ischiofemoral pain

Martin et al 2019, Martin et al 2010

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Management of Posterior Impingement

Load Management

-Reduce time spent in positions of impingement esp sustained, repetitive, loaded, rapid actions into hip extension/ER/Add

*Consider position of pelvis – anterior pelvic translation and posterior pelvic tilt results in relative hip extension

Exercise

-Optimise hip flexor and abductor function to prevent excessive hip extension/adduction

-Also important if assoc anterior instability

-Address other individual impairments

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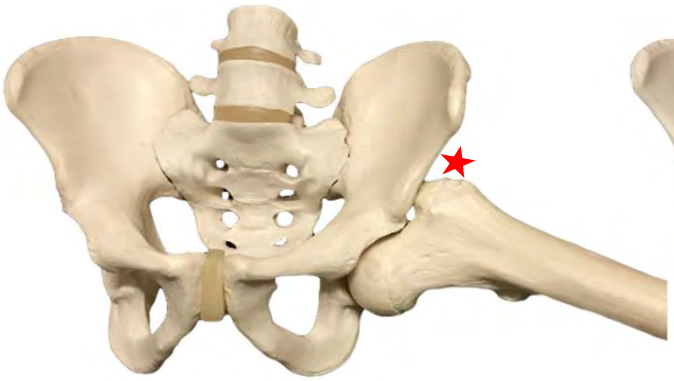
Extra-articular impingement of the GT

GT – Pelvic Impingement



GT – Ischial Impingement

Bardakos 2015, de Sa et al 2015

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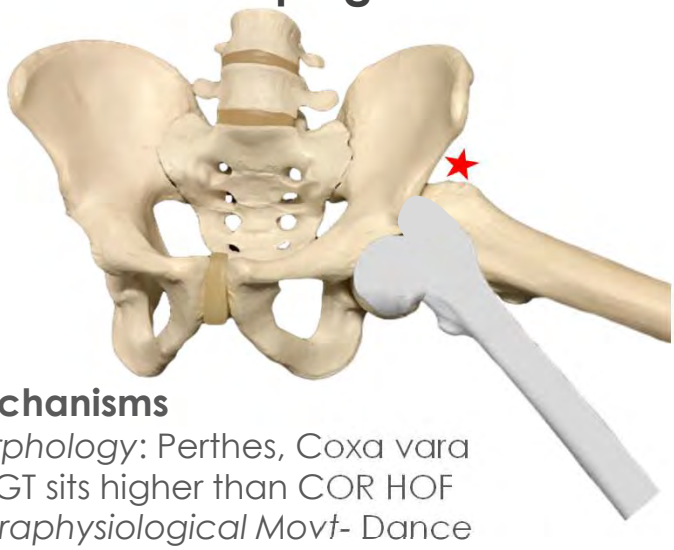
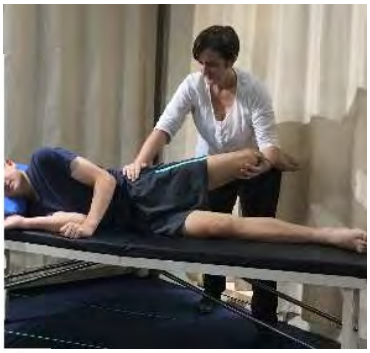
Extra-articular impingement of the GT

GT – Pelvic Impingement



Mechanisms
Morphology: Perthes, Coxa vara
Tip GT sits higher than COR HOF
Supraphysiological Movt- Dance
May have groin pain & inf subluxation

Lateral Rim Impingement Test



Scoop hip from Hip Flexion to Extension/ER in abduction
+ve: LHPain Reproduction

Bardakos 2015, de Sa et al 2015

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Management of GT – Pelvic Impingement

Load Management

-Reduce time spent in positions of impingement esp sustained, repetitive, loaded, rapid actions into hip **abduction** – e.g sustained side splits, stretching into hip ranges of abduction

-Decompression for Perthes may only be possible surgically

Exercise

-Optimise deep external rotators & adductor function to control HOF from inferior joint aspect & move GT posteriorly

-Improve abductor health and endurance in non-impinging ranges

-Address other individual impairments

Extra-articular impingement of the GT

GT – Ischial Impingement

Mechanisms

Morphology:Coxa valga & +anteversion
Supraphysiological Movt- Dance
May have ant hip pain & ant instability

FABER Test

Hip Flexion abduction/ER
+ve: Reproduction pain in ischial tunnel +/- SN symptoms

Kivlan et al 2016, Martin et al 2019

Management of GT – Ischial Impingement

Load Management

-Reduce time spent in positions of impingement

esp sustained, repetitive, loaded, rapid actions into **flexion / abduction / external rotation**

****Important to assess fem anteversion – do not push to increase ER ROM!**

Exercise

-Optimise anterior joint support – hip flexors & anterior, internally rotating abductors –Ant GMed & Min

-Optimise health of QF if it has become painful associated with direct bony impingement

-Sciatic nerve gliding techniques

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Joint Related Pain & Bony Impingements

Ischiofemoral Impingement

Part 1: What & Why

Module 1 – Lesson 4

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Ischiofemoral Impingement

WHAT? → **Sources of Nociception**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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What is Ischiofemoral Impingement?

Extra-articular bony impingement
IFI: Pain associated with soft tissue impingement between the lesser trochanter & ischium

Bardakos 2015, Beckman et al 2015, Blankenbaker & Tuite 2013, de Sa et al 2014

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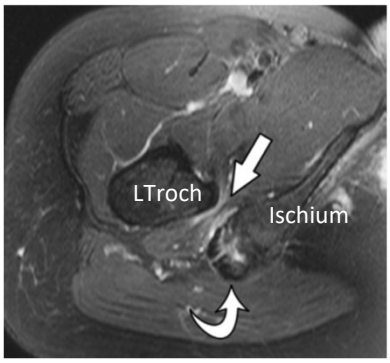
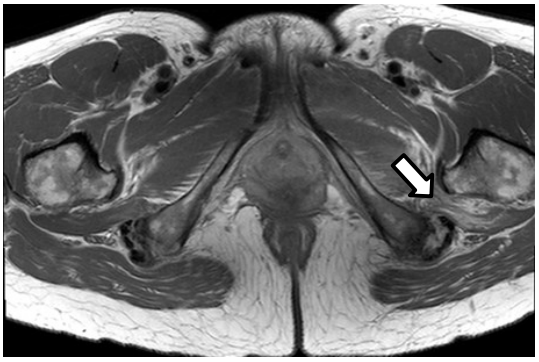
What are the sources of Nociception?





Associated with impingement between lesser trochanter & ischium
Quadratus Femoris
Proximal hamstring and iliopsoas tendons
Sciatic nerve

Taneja et al 2013, Torriani et al 2009, Tosun et al 2012

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Ischiofemoral Impingement

WHAT? → **Sources of Nociception**
WHY? → **Mechanisms**
HOW? → **Clinical Indicators**
→ **Management**

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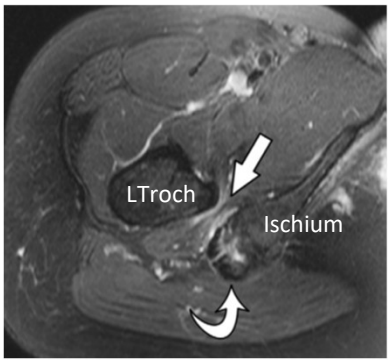
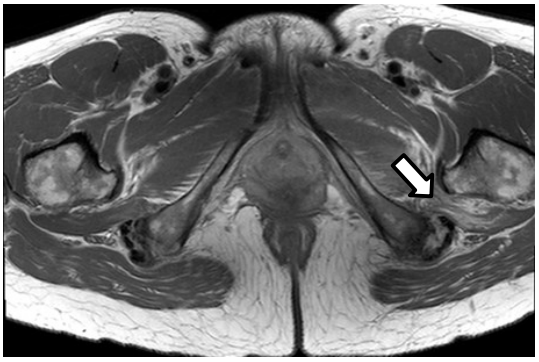
IFI: Mechanisms



Structural
Anatomical variants resulting in reduced IF Space
Primary/Secondary - Acquired



Functional
Functional positions or movement patterns resulting in excessive dynamic reduction of IF Space

Taneja et al 2013

Structural IFI

Primary Bony Factors:
Femoral morphology:
- Femoral neck length & neck-shaft angle
- Lesser trochanter size
- Lesser trochanter & femoral neck version

Pelvic morphology:
- Ischiopubic ramus size & orientation

Structural IFI

Primary Bony Factors:

Femoral morphology:

Femoral neck length & neck-shaft angle

Coxa Breva (short neck)

Usually associated with Slipped Capital Femoral Epiphysis or AVN

Hernando et al 2016, Stevens & Coleman 1985

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Structural IFI

Primary Bony Factors:

Femoral morphology:

Femoral neck length & neck-shaft angle

Coxa Valga (more vertical neck)

IFI: Femoral neck-shaft angle significantly higher compared with controls*

3D CT reconstruction & collision software** demonstrated impingement through ROM in Valgus hips, esp with fem anteversion, primarily occurs posteriorly between the LT & ischium

Poorer hip abductor muscle lever arm, adding functional IFI component

Tosun et al 2012*, Siebenrock et al 2013**

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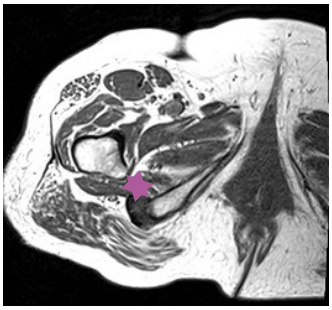
Structural IFI

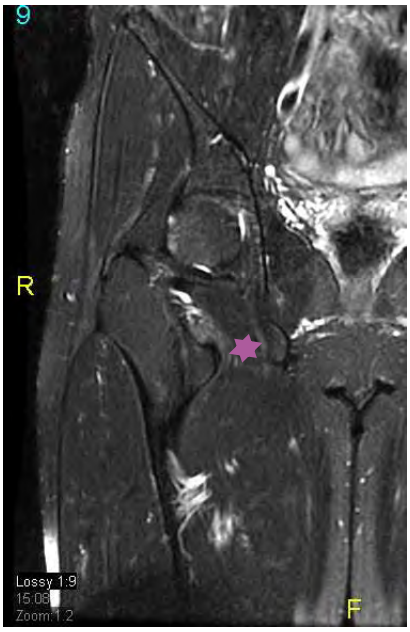
Primary Bony Factors:

Femoral morphology:

- Lesser trochanter size

Prominent Lesser Trochanter
More common in females





Tosun et al 2012, Gómez-Hoyos et al 2016

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Structural IFI

Primary Bony Factors:

Femoral morphology:

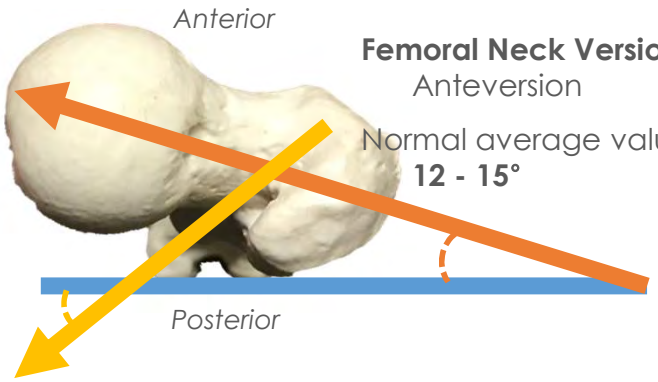
Lesser trochanter & femoral neck version

Lesser Trochanter Version
Retroversion

Normal average values:

May be quite variable

- 24°, range 17 to – 54°



Femoral Neck Version
Anteversion

Normal average values:
12 - 15°

Tosun et al 2012, Gómez-Hoyos et al 2016

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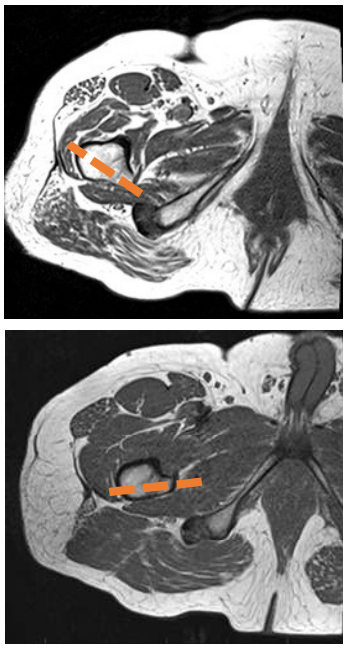
Structural IFI

Primary Bony Factors:
Femoral morphology:
Lesser trochanter & femoral neck version

No difference in LT Version in IFI



Tosun et al 2012, Gómez-Hoyos et al 2016

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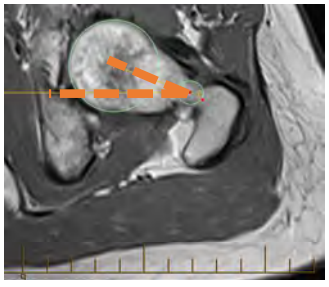
Structural IFI

Primary Bony Factors:
Femoral morphology:
Lesser trochanter & femoral neck version

Excess femoral neck anteversion in IFI
IFI: 21.7 ± 10.4 vs Controls: 14.1 ± 10.8*

& increased femoral neck axis angle**
IFI: 19.7 ± 11.1° vs Controls: 15.5 ± 12.1°

Femoral anteversion may have a substantial impact on dynamic hip rotation & IFS



Gómez-Hoyos et al 2016*, Bredella et al 2015**

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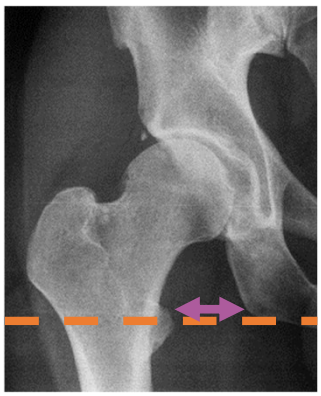
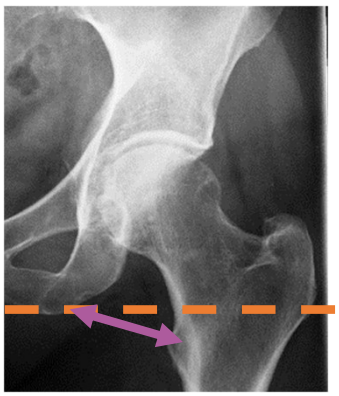
Structural IFI

Primary Bony Factors:

Pelvic morphology:

- Ischiopubic ramus size & orientation





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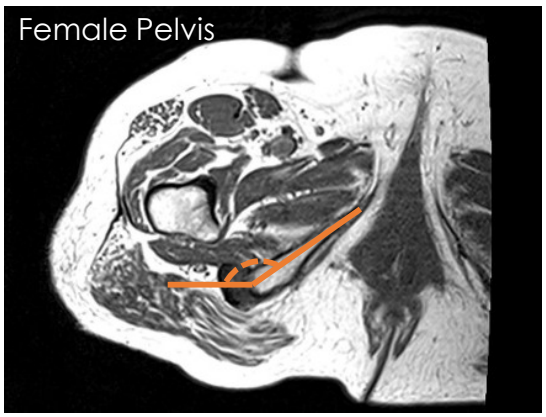
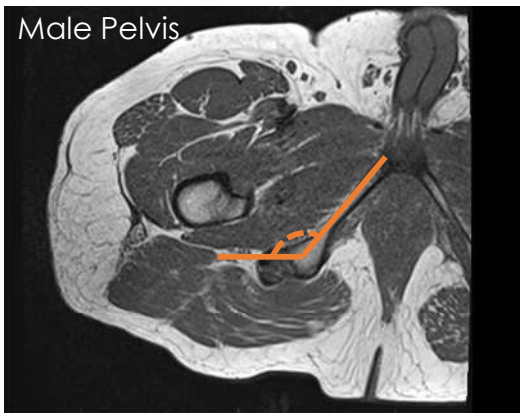
Pelvic Morphology: Ischiopubic ramus angle





Females have greater ischiopubic angle than males
Subjects with IFI - increased angle compared with controls
IFI:130.6±4.9° vs Controls:128.0±6.2 °
- remained significant after controlling for gender

Bredella et al 2015

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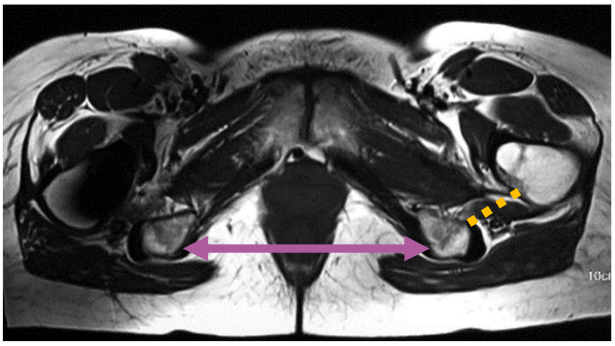
Pelvic Morphology: Intertuberous distance

Related to ischiopubic ramus angle
Negative correlation between intertuberous distance & IFSpace

Larger in females than males

May contribute to higher prevalence of IFI in women



Sussman et al 2013, Maraş Özdemir et al 2015, Atkins et al 2017

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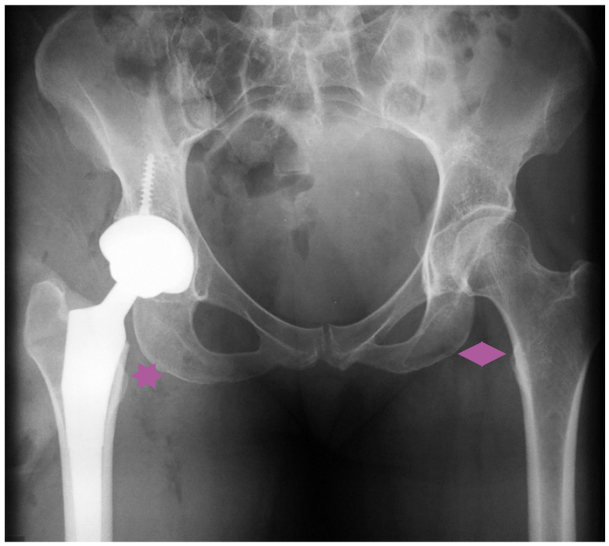
Structural IFI

Acquired Factors:

Femoral offset
- Post Total Hip Arthroplasty
- Intertrochanteric valgus osteotomy
- Intertrochanteric #



Johnson 1977, Taneja et al 2013

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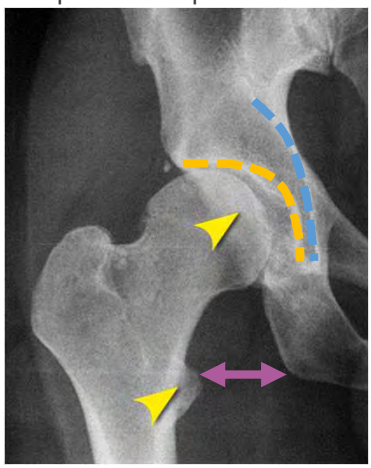
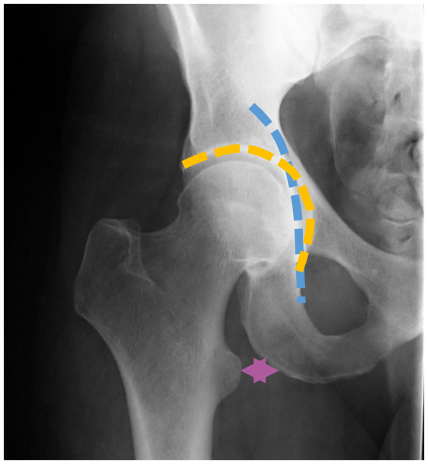
Structural IFI

Acquired Factors:

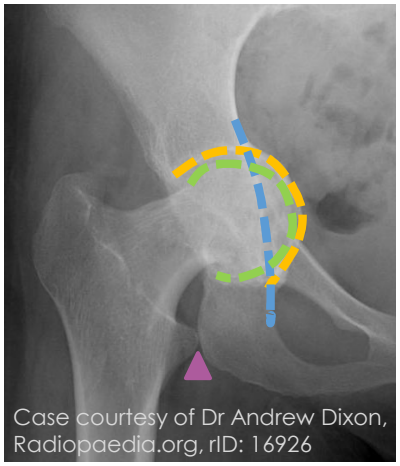
Hip OA Superomedial



Coxa Profunda



Acetabular Protrusio



Hernando et al 2016, Taneja et al 2013

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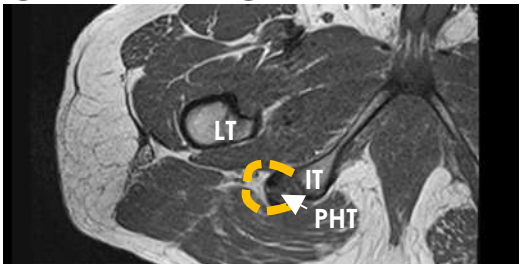
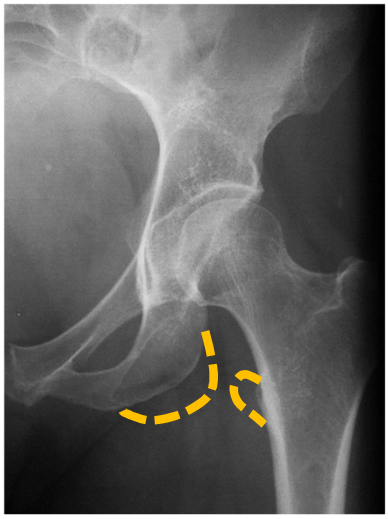
Structural IFI

Acquired Factors:

Post lesser trochanter avulsion #
Post ischial tuberosity avulsion #

Proximal Hamstring Tendinopathy
- larger hamstring tendon area in IFI





Hayat et al 2014, Spencer-Gardner et al 2017, Tosun et al 2012

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Structural IFI

Acquired Factors:

Tumour
- Osteochondroma of lesser trochanter or ischium
- Lipoma

Hernando et al 2016, Papoutsi et al 2016

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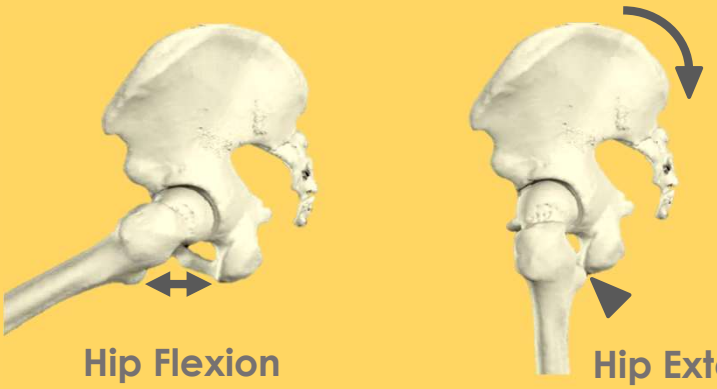
Functional IFI



Hip Flexion **Hip Extension &/or PPT**

Ischiofemoral space is functionally reduced in:
Hip Extension & Posterior Pelvic Tilt (PPT)

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Functional IFI

Ischiofemoral (IF) space is functionally reduced in:
Hip Adduction
External Rotation

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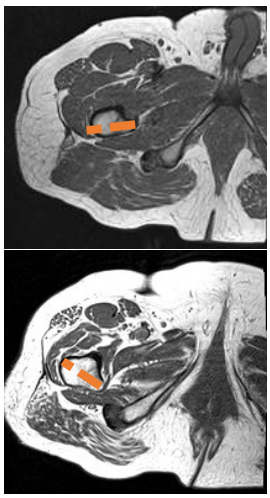
The effect of Hip Position on IFS

Hip Position	Neutral	40° IR	60° ER
IFS mm	28 ± 1.1	43 ± 1.2	14 ± 0.7



*In 10° hip extension & adduction,
IFI occurred in 84 % of hips at 29° (SD 20) of ER
High variability in range of impingement
Likely reflective of high range of variability in LTV

** ER in neutral resulted in IFI in 17.0% of 206 hips
IFI occurred in adduction in 78.6% of hips

Kivlan et al 2017*, Morris et al 2018

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The effect of Hip Position on IFS

Ultrasound Study*:
Largest ischiofemoral space in Abduction – Internal Rotation
Smallest ischiofemoral space in Adduction – External Rotation

Flouroscopy Study **:
IFS reduced with Extension, Adduction & External Rotation

Finnoff et al 2015*, Atkins et al 2017**

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Functional/dynamic impingement

Hip Extension & Adduction key factors
Effect of ER variable depending on hip position & morphology

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Functional/dynamic impingement

Position/Function	Male mm (n=6)	Female mm (n=5)
Supine MRI	26.0 (22.1-30.3)	20.9 (17.5-24.0)
Standing Flouro	30.4 (27.2-33.8)	20.9 (19.3-22.3)*
Walking on level	21.1 (18.7-23.6)	8.8 (7.5-9.9)*
Walking on incline	21.3 (18.9-24.1)	9.1 (7.4-10.8)*

'Use of the axial IFS to estimate the dynamic IFS may be inconsistent and unreliable'
'Sex-based differences in the dynamic IFS may be caused by a combination of subtle variations in both kinematics and anatomy'

Atkins et al 2017, *significant

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Functional/dynamic impingement

Gait Characteristics potentially predisposing to IFI:
- Overstriding
- Excessive lateral pelvic drop
- Excessive lateral pelvic shift
- Midline/cross-midline striking

Impairments
- Abductor weakness or mechanical insufficiency

DiSciullo et al 2018, Hernando et al 2016

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Next: Ischiofemoral Impingement

WHAT? → Sources of Nociception
WHY? → Mechanisms
HOW? → Clinical Indicators
→ Management

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Joint Related Pain & Bony Impingements

Ischiofemoral Impingement
Part 2: How

Module 1 – Lesson 5

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Ischiofemoral Impingement Part 2

WHAT? → **Sources of Nociception**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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CLINICAL INDICATORS

Interview Features

Pain lateral to ischium

+/-saddle/groin pain

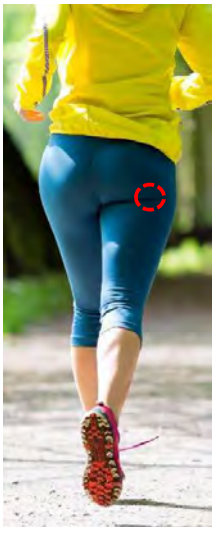
+/- upper post thigh

+/- Sciatic nerve symptoms

Pain with: Walking/Running

Activities involving hip extension, single leg loading

May sometimes report a snapping/clicking, usually with walking/running



Impact:

Reduced activity levels

Reduced sporting performance

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CLINICAL INDICATORS

Physical Features

Pain lateral to ischium reproduced with:

Long Stride Walking (LSW Test)

Pain on long strides is alleviated by walking with short strides

Ischiofemoral Impingement Test (IFI Test)

Pain on hip extension in neutral or adduction is alleviated with extension in abduction

Palpation

Tenderness on palpation of the lateral aspect of the ischium

Gómez-Hoyos et al 2016

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Diagnostic Properties of Tests for IFI

Gómez-Hoyos et al 2016	Long Stride Walking	IFI Test
Sensitivity (%)	94	82
Specificity (%)	85	85
PPV (%)	89	88
NPV (%)	92	79
Positive LR	6.12	5.35
Negative LR	0.07	0.21
Diagnostic OR	88.8 (7.08-1,094.01)	25.6 (3.63-181.44)

Examined how well these tests correlated with a confirmed diagnosis of IFI.

Diagnosis required:

- primary issue of posterior hip pain
- abnormal MRI or CT
(abnormal IFS, QFS & QF muscle oedema)
- at least 60% pain relief from surgery
- negative IFI tests post op

Study Quality:

Low numbers 30: 17 +ve IFI; 13 –ve
Retrospective, only surgical cases, 1 surgeon, No blinding

➡ Diagnostic Utility likely to be overestimated

PPV: Positive Predictive Value; NPV: Negative Predictive Value; LR: Likelihood Ratio; OR: Odds Ratio

Gómez-Hoyos et al 2016

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Imaging

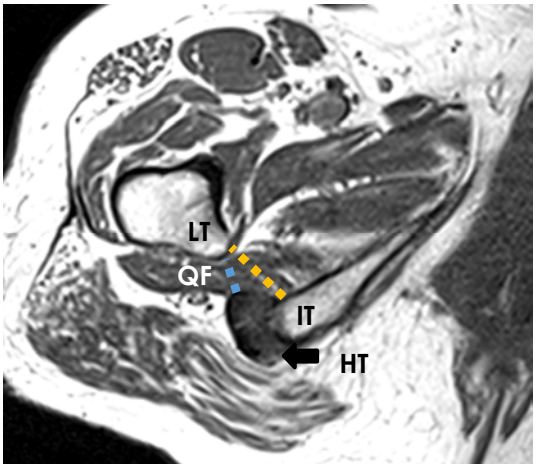
MRI: Gold Standard for Imaging

Ischiofemoral Space:

'smallest distance between the lateral cortex of the ischial tuberosity & medial cortex of the lesser trochanter'

Quadratus Femoris Space:

'smallest space for passage of the QF muscle bordered by the superolateral surface of the hamstring tendons and the posteromedial surface of the iliopsoas tendon or lesser trochanter'



QF: Quadratus Femoris; LT: Lesser Trochanter; IT: Ischial Tuberosity; HT: Hamstring Tendons

Tosun et al 2012

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Measurement thresholds for radiologic diagnosis

Results of pooled meta-analysis: 217 IFI & 140 control cases

Diagnostic utility of IFS & QFS MRI measures in diagnosing IFI

Positive Diagnosis: QF Oedema +/or atrophy & ipsilateral hip pain

	Cut Off	SN	SP	Acc	OR
IFS mm	**≤15 mm**	76.9 %	81.0 %	78.3 %	1.6 (1.18-2.06) p=0.002
QFS	**≤10 mm**	78.7 %	74.1 %	77.1 %	1.6 (1.37-1.87) p=0.0001

Recommended cut-offs that produce the best balance of SN & SP

OR: Each 1-mm ⬇ IFS/QFS = ≈60 % ⬆ in odds of symptomatic IFI

Singer et al 2015

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Radiographs

Useful screening tool for IFI

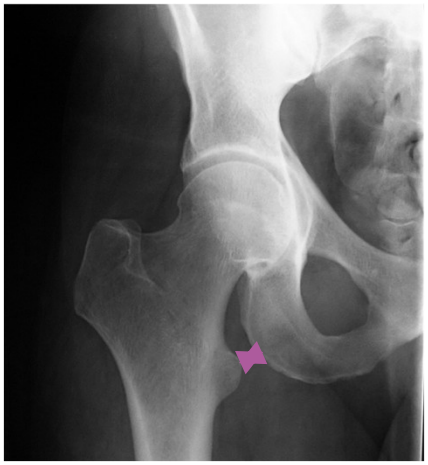
IFS measures - good correlation with MRI

Suggested Cut-Offs:

- **Supine Xray: 20mm**
- **Standing Xray: 19mm**

Also useful to assess other structural factors

Standing more functional



Park et al 2016

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Radiographs – False Profile View

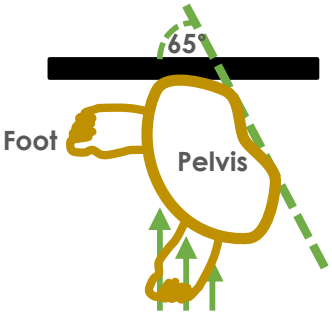
Better able to view LT

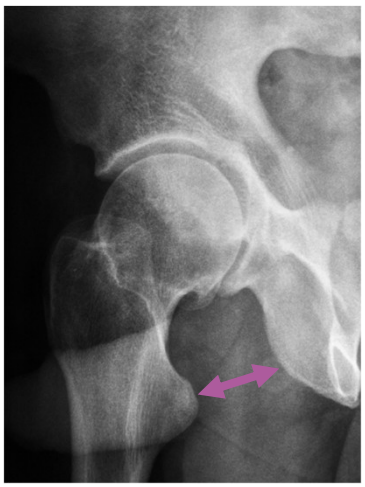
Taken with pelvis rotated 65° from the line of the foot

Foot parallel to cassette

*Hip in ER

Suggested Cut-Off:**10.3 mm** (n=116; SN: 88.6%; SP: 88.4%)





Diagnosis of IFI: +ve IFI test & QF Oedema on MRI

Kwak et al 2018

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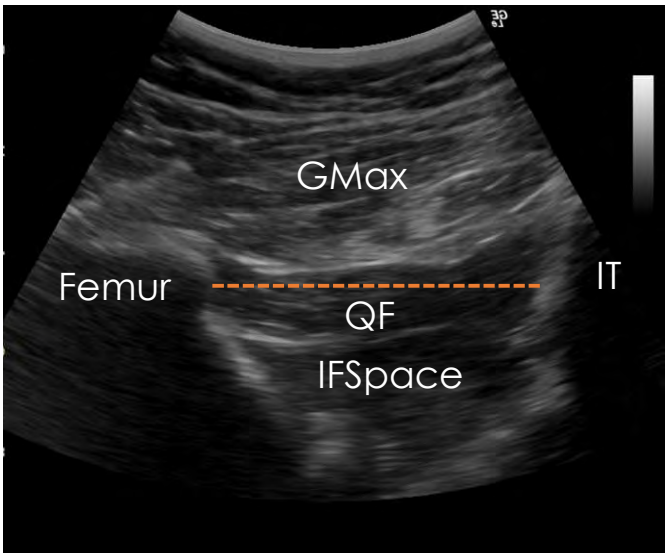
Ultrasound

Validated against MRI
Both measured in prone
5 females; 5 males;
Asymptomatic
IFS (MRI): 28.25 ± 5.91
IFS (US): 29.5 ± 4.99
Mean difference: 1.25mm
NSD between measures



Finnoff et al 2015, 2017, Johnson et al 2017

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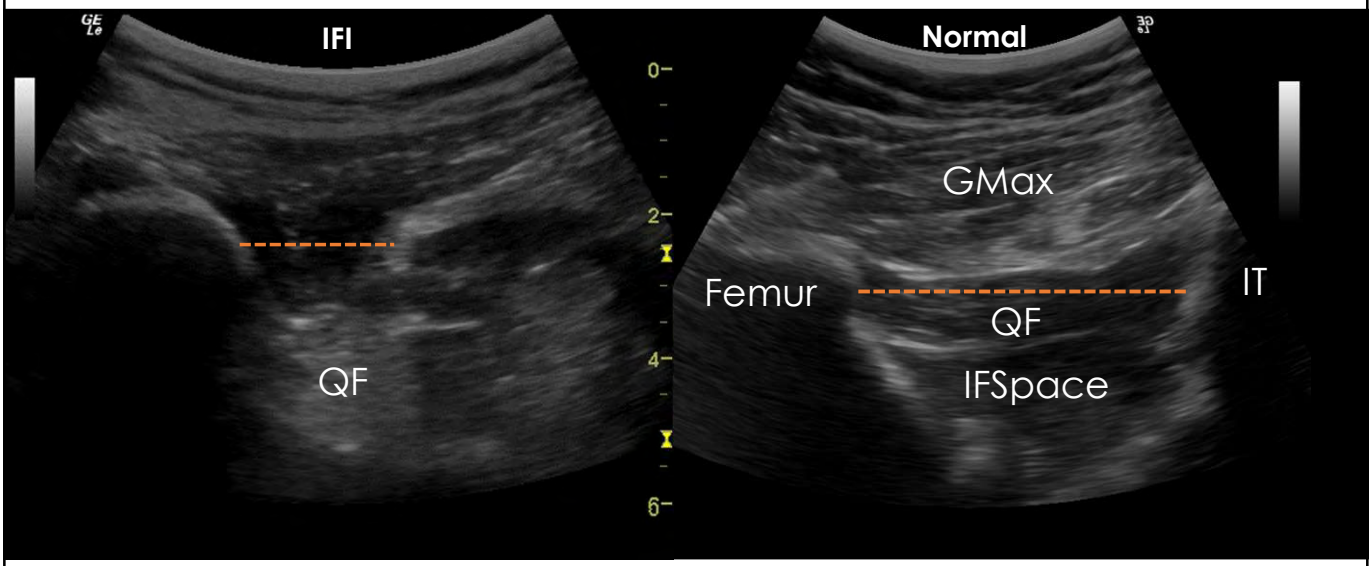
Ultrasound



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MRI Findings in Asymptomatic Subjects

Prospective, 418 hips of 209 volunteers (126 male; 83 female)
Normative mean values: IFS:25.6mm; QFS:15.6mm

- IFS decreases with age
- Asymmetry of IFS is normal
- QF abnormalities may be present in the absence of pain

9.1% QF signal abnormalities

(Oedema 1.4%, Fatty infiltrate 7.7%)

Abnormalities more likely if:
- Older, female
- Larger ITD, lower IFS & QFS

% Difference IFS Between Sides	% of Participants
≥ 5%	71.8%
≥ 10%	49.3%
≥ 20%	18.7%
≥ 30%	6.2%

ITD: Intertuberous distance; IFS: Ischiofemoral space; QFS: Quadratus Femoris Space

Maraş Özdemir et al 2015

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At present a confident diagnosis may require:

- **Patient report of pain lateral to the ischium**
  ± groin & upper posterior thigh
- **Positive physical tests**
  - Long stride walking, IFI Test, +/- TOPalpation of lat ischium
- **Imaging signs**
  - Reduced IFSpace ≤ 15mm, QFSpace ≤ 10mm on axial MRI
  - QF Oedema +/or atrophy on MRI

  Functional IFI may have QF changes with IF & QF space above cutoffs

  Role of imaging

Kwak et al 2018

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Buttock Pain: Ischiofemoral Impingement

WHAT? → Sources of Nociception
WHY? → Mechanisms
HOW? → Clinical Indicators
→ Management

Managing IFI – **Case Study Evidence Only**

NON – SURGICAL MANAGEMENT

- Injection
- Anti-inflammatories
- Rest/activity modification
- Physiotherapy
  - Stretching – of what?
  - Strengthening – 'hip muscles', QF, abductors – how?
  - Heat, US, electrical Rx

SURGICAL MANAGEMENT

- Endoscopic surgery
  - Partial or full resection of LT
- Open Surgery
  - Resection of LT
  - Resection of exostoses or tumours
- Good short-medium term outcomes with a low rate of complication

Nakano et al 2018, Gollwitzer et al 2017

Managing IFI – Non Surgical

- Yanagishita et al 2012: 'antiinflammatory drug for seven days and daily physical therapy for stretching and strengthening the pelvic muscles, with progressive improvement of symptoms'
- Lee et al 2013: 'Hot pack, ultrasound, and interferential current therapies were applied around the hip area. She received an exercise program for stretching of the hip muscle and connective tissues. The exercise program was targeted to the quadriceps femoris, piriformis, and other hip muscles.'
- DiSciullo et al 2018: '… in patients with possible dynamic IFI, treatment options could emphasize abductor strengthening and treatment of the underlying cause of the gluteal pathology'

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KEY NON-SURGICAL MANAGEMENT STRATEGIES

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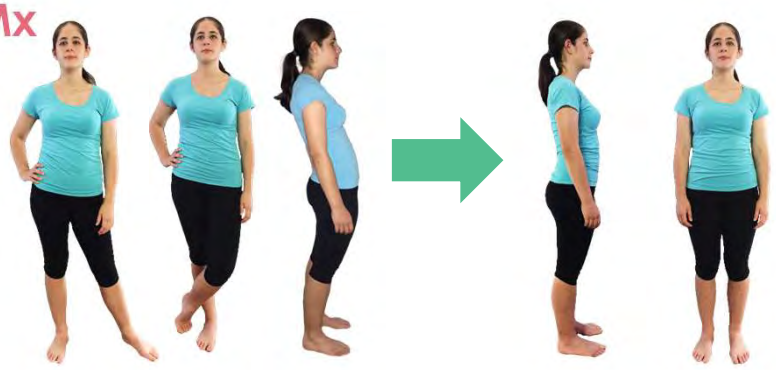
Load Management for IFI
Minimise exposure to:

Compression	•Positions of combined extension & adduction +/or external rotation •Consider sustained postures & stretches
Compression & friction	•Walking/running •Overstriding, narrow base, poor proximal control •Swimming kick

ISCHIOFEMORAL IMPINGEMENT

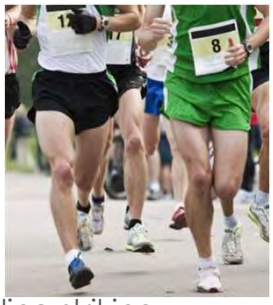
Load Mx in ADL



Posture & gait re-education are key

ISCHIOFEMORAL IMPINGEMENT

Load Mx in Sport, Recreation



Excess lateral pelvic tilt & femoro-pelvic adduction

Midline striking

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Addressing dynamic impingement

Potential problem	Examples of Intervention
Overstriding	Reduce stride length, increase step rate, land softly
Excessive lateral pelvic drop or lateral shift	Address any associated overstriding, lead with knee, Abd strengthening, Motor control training
Midline/cross midline striking	Address any abductor weakness, 'run wider', run feet either side of a line

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Exercise therapy for IFI

Gentle isometric QF
Avoiding Impingement

Movement Training
Frontal & sagittal plane contro

Abductor Strengthening

Adductor Lengthening

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Manual therapy for IFI

No evidence for usefulness of manual therapy

May assist in those with superomedial hip OA or restricted capsule resulting in excessive adduction or external rotation

Try belt mobilisations

- Passive
- Dynamic, e.g during a squat or step - through action

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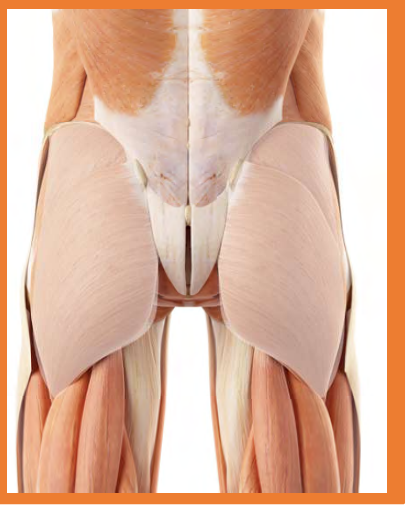
Focus Modules

Joint Related Pain & Bony Impingements

Soft Tissue Related Pain
Muscle, Fascia, Tendon, Bursa



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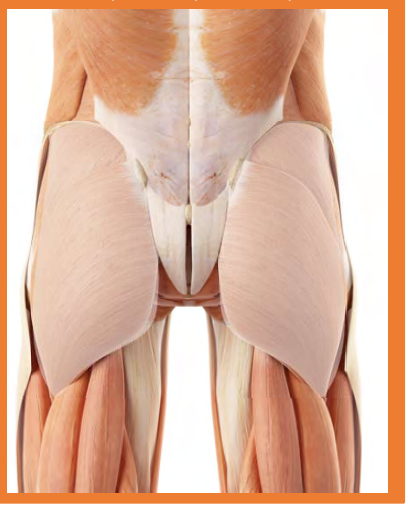
Module: Soft Tissue Related Pain
Muscle, Fascia, Tendon, Bursa



BUTTOCK PAIN
Soft Tissue Related Pain
Muscle, Fascia, Tendon, Bursa

Module 2 – Lesson 1

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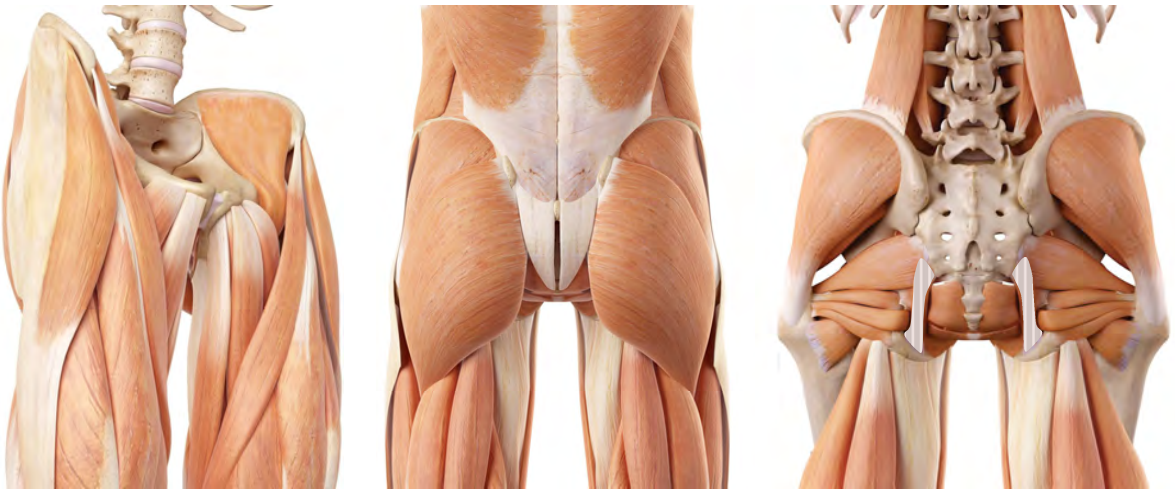
Muscles



Acute injury relatively rare in buttock musculature
Pain may arise due to overuse
– DOMS, overtraining, kinematics/structure/muscle function

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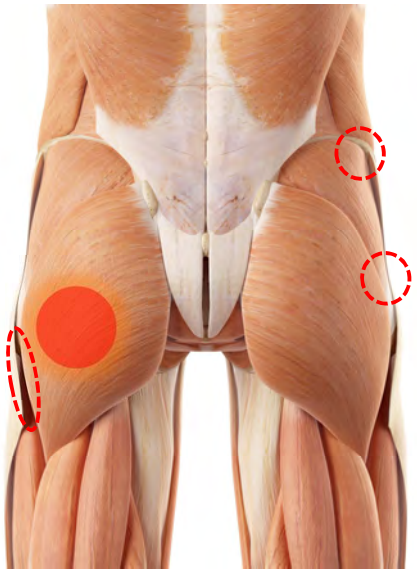
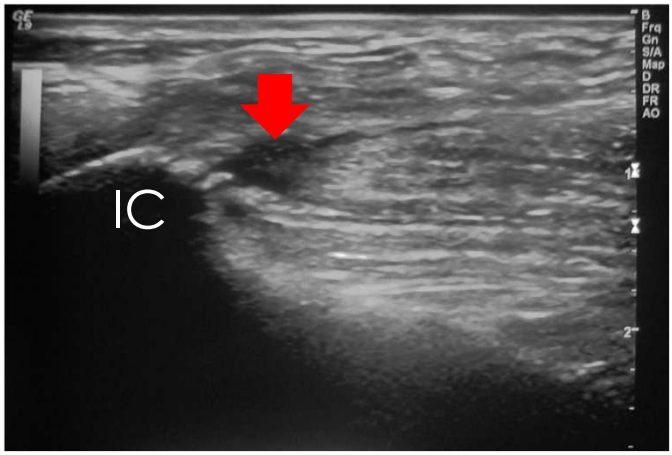
Acute muscle injury





Gluteus medius muscle tear at iliac origin

Kara et al 2015, Mehta et al 2015

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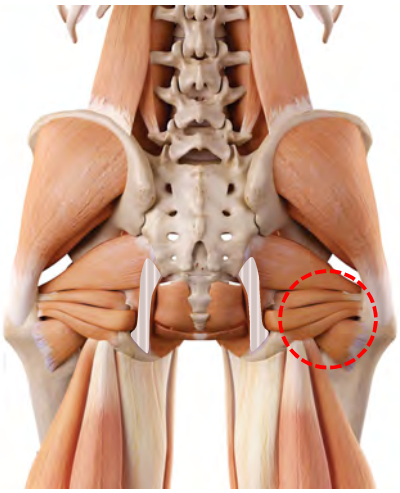
Acute muscle injury



Obturator internus or externus muscle injuries more commonly occur at obturator foramen/pubic ramus; more likely to present with groin pain

Kassarjian 2008, Kassarjian et al 2011

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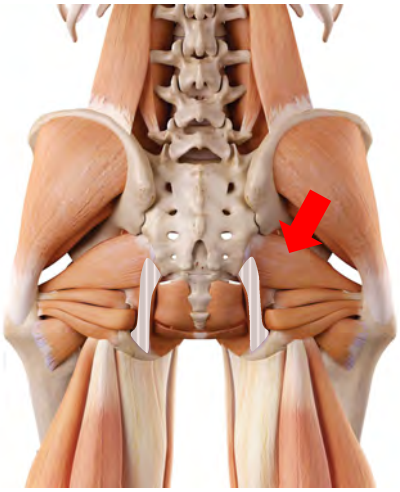
'Piriformis syndrome'



Grossly overused/misused term

'Piriformis syndrome'
= sciatic neuralgia
(associated with entrapment under/in piri)
≠ painful piriformis muscle

The piriformis muscle may be a source of pain but this should not be termed 'piriformis syndrome'

Piriformis muscle pain may co-exist with Piriformis syndrome

See Nerve Related Pain Module

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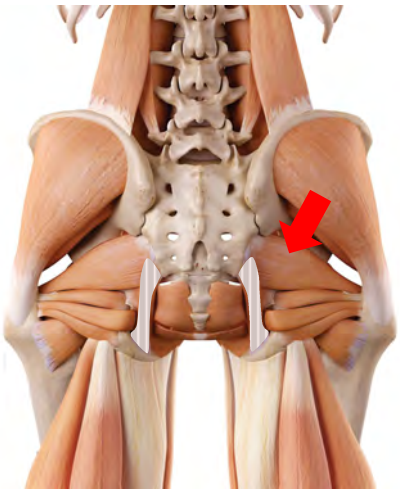
Piriformis muscle overload



May develop in association with:

- Unaccustomed, strong &/or repetitive hip abduction/rotation activities

- Weakness/dysfunction of it's synergists
  - gluteus medius/minimus
  - short external rotators
- Loading of the SIJ, particularly when passive stability mechanisms are insufficient

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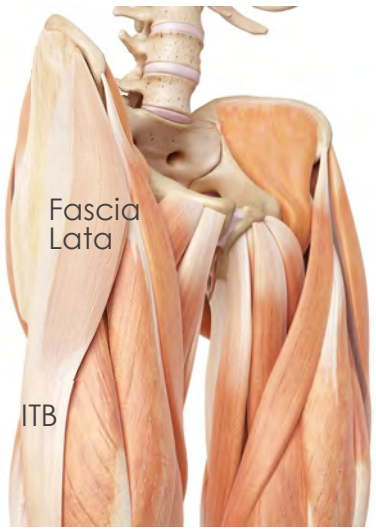
Fascia



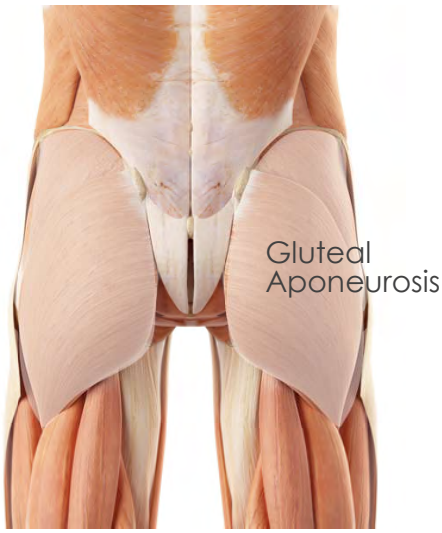
Highly innervated, ++ nociceptors

Force transference

Energy storage

Augments stability
- ITB: lateral hip/knee

ITB & ITB tensioners
≈ 30% BW in SLS



Huang et al 2013, Schleip & Baker 2015, Zügel et al 2018

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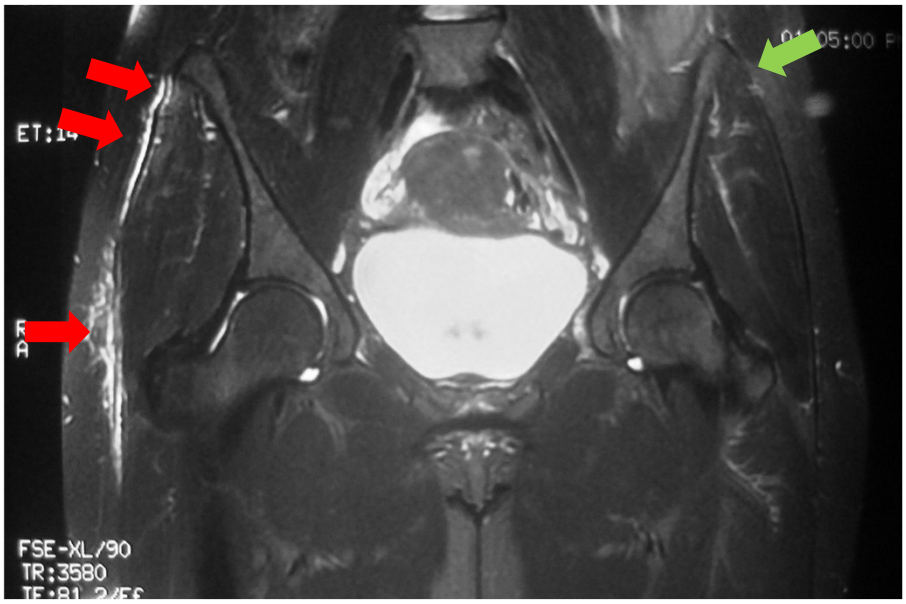
Acute fascial injury



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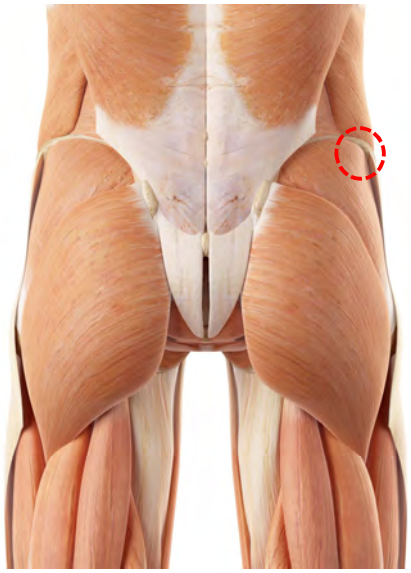
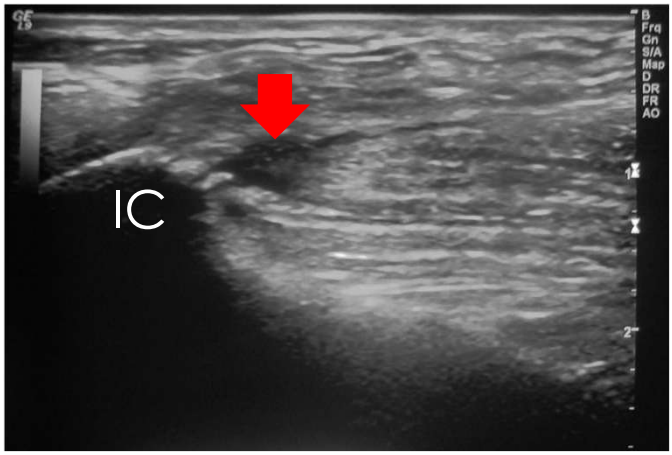
Acute fascial injury





Gluteus medius muscle tear at iliac origin + fascia lata tear

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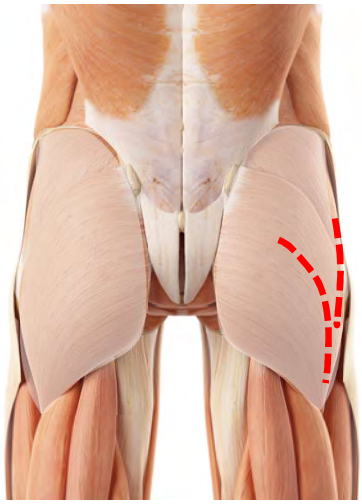
Iatrogenic fascial injury



Effect of surgical incision??

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'Fasciopathy' & Degenerative Fascial Change

Age-related alterations in fascial tissue
- densification (alterations of loose connective tissue)
- fibrosis (alterations of collagen fibrous bundles)

Prolonged or repetitive load
- persistent inflammation may develop – prolonged presence of pro-inflammatory cytokines (IL-1β, TNF, TGFβ-1)
- can promote fibrosis
- maintains sensitisation of nociceptive afferents
- results in increased production of Substance P, which can also stimulate fibrosis & contribute to pain states

Zügel et al 2018

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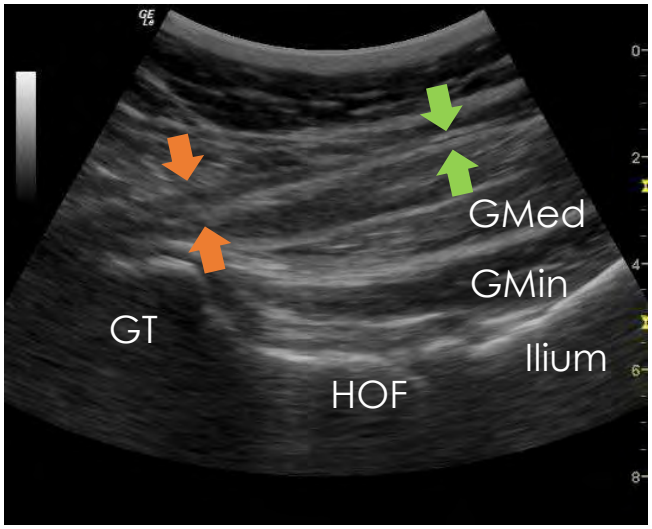
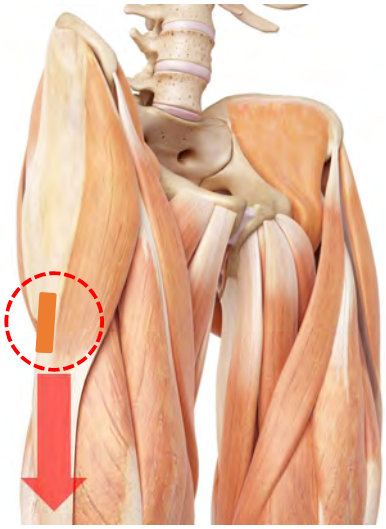
ITB Fasciopathy in Greater Trochanteric Pain

Thickening of ITB over GT reported in 29% of 877 with GTPS





Long et al 2013, Huang et al 2013

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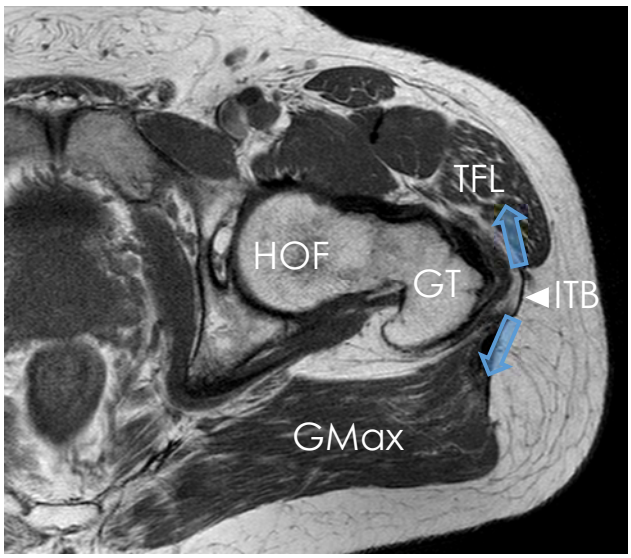
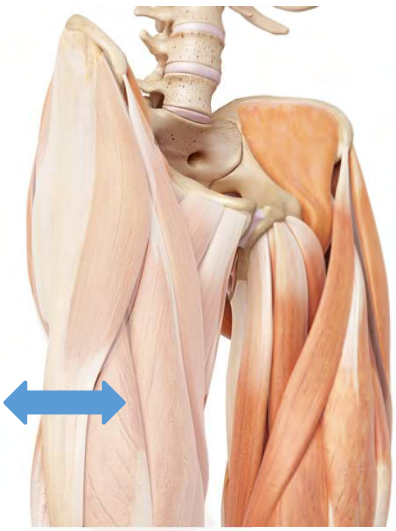
External Coxa Saltans – Lateral Snapping Hip





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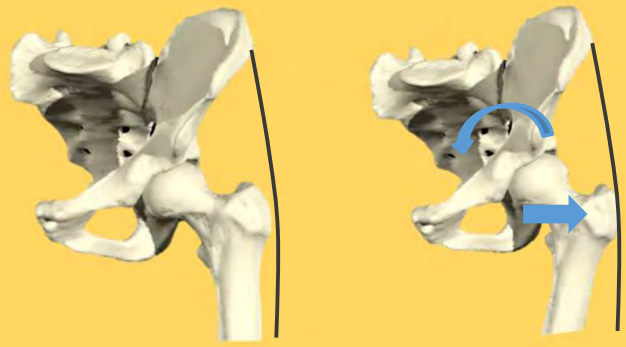
External Coxa Saltans – Lateral Snapping Hip



Impairments

- Reduced eccentric hip abductor strength
- No difference in gait pattern
  - Only 13 subjects – low power
  - Likely differing patterns
- ITB length - short or long ??
- Generalised joint hypermobility common in this group

Jacobsen et al 2012, 2013, Allison et al 2016

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External Coxa Saltans – Lateral Snapping Hip

Management

- Optimise lateral pelvic control & cues for gait – 'up tall', 'feet wider'
- May require hip abductor & extensor strengthening
- May require 'downregulation' strategies for anterior thighs & patterning strategies for squat
- Surgical Mx involves ITB lengthening/release – poor quality evidence. Effect on ITB function? Must exhaust good non-surgical Mx prior to considering.

Mokha et al 2015, Pierce et al 2018 – Surgical SRV

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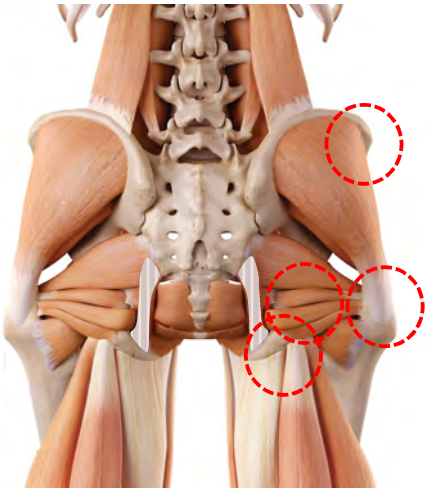
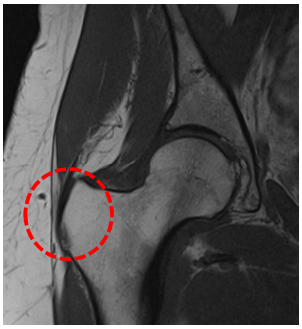
Tendons

TFL Tendinopathy; Obturator Internus Tendinopathy





Gluteal Tendinopathy

Proximal Hamstring Tendinopathy

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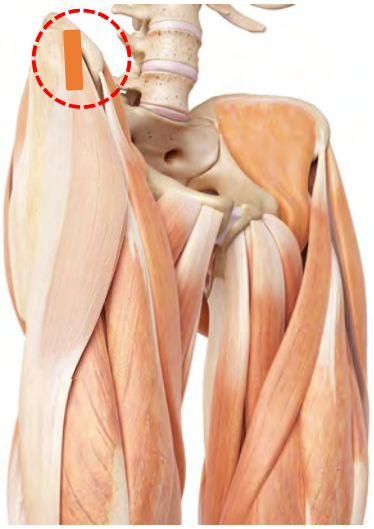
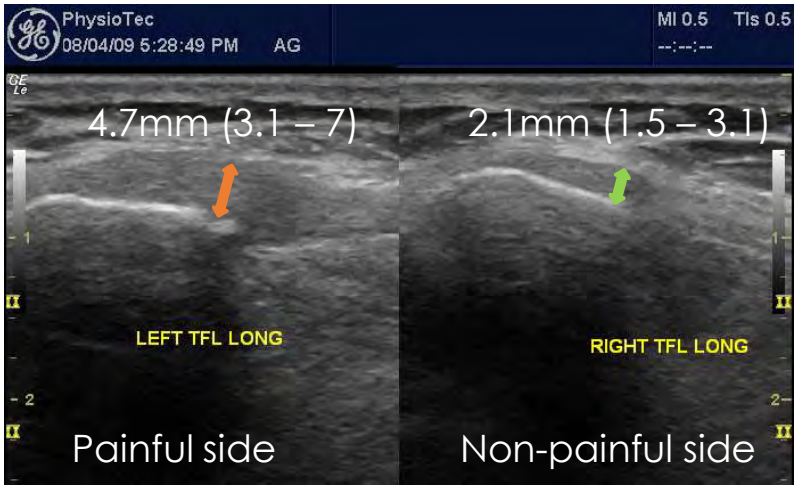
TFL Tendinopathy – Proximal ITB Fasciopathy





Bass & Connell 2002, Huang et al 2013

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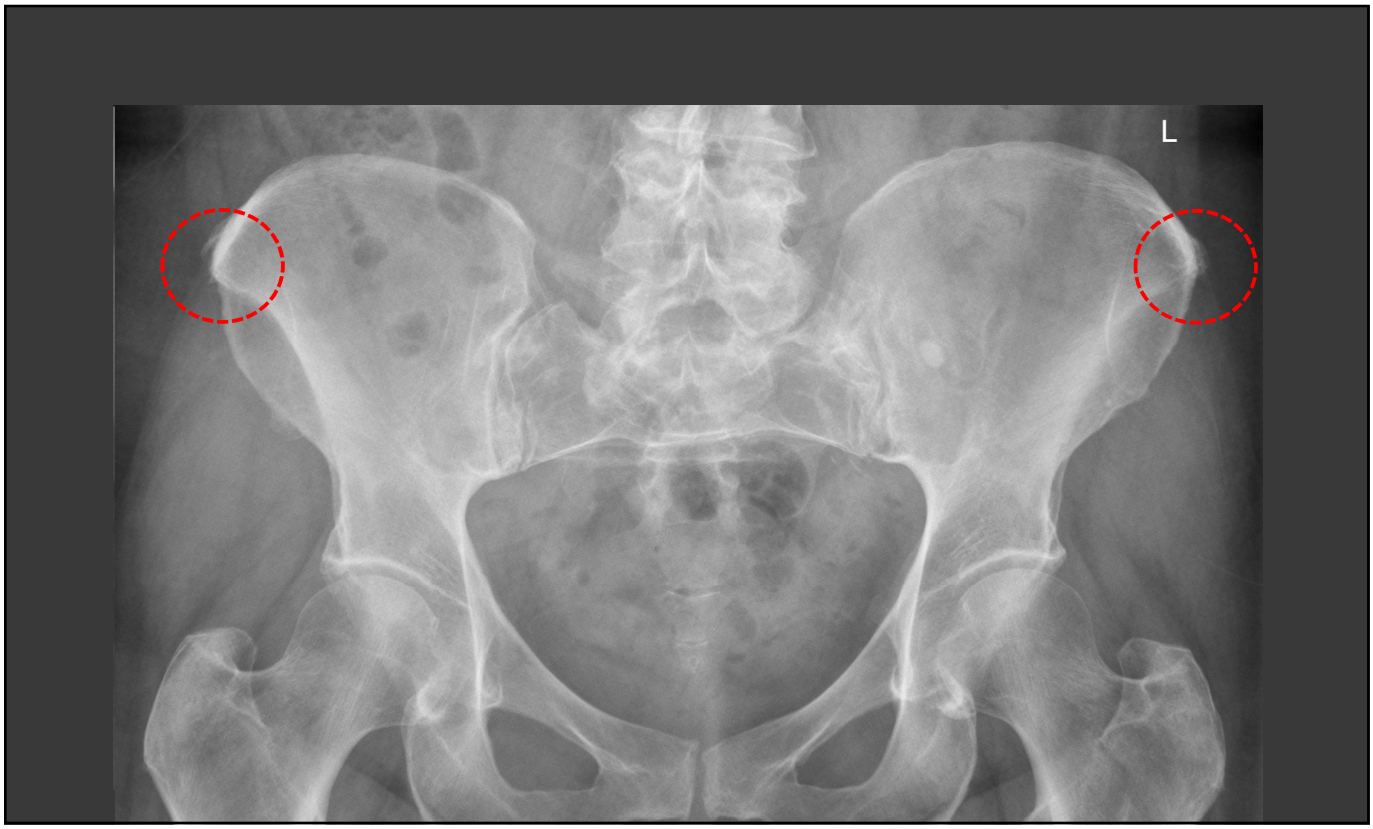

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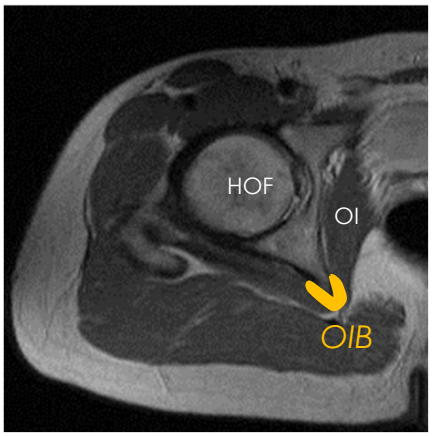
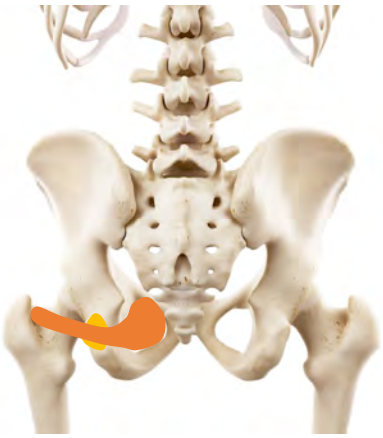
Obturator Internus Tendinopathy & Bursitis

Consider this diagnosis in those presenting with retrotrochanteric pain

Axial MRI: Level of HOF





Your hip OA program may be having an effect due to improvements in health & reduction of nociception from local soft tissues.

Meknas et al 2011, Chen et al 2017, Cox & Bakkum 2005, Walters et al 2014

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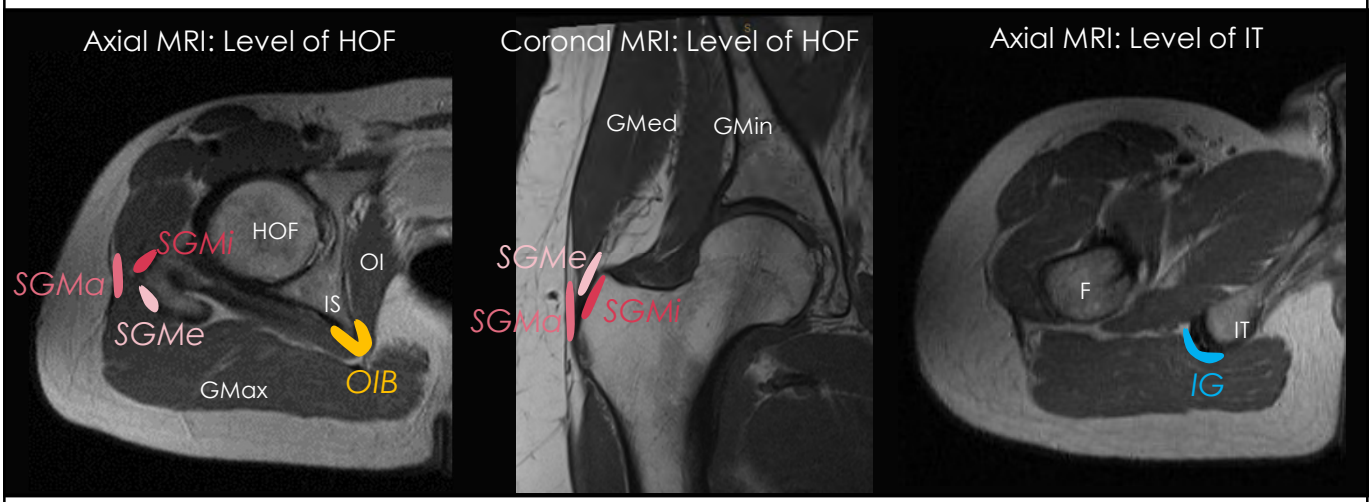
Bursae of the Lateral Hip & Buttock



SGMa: Subgluteus Maximus (Trochanteric) Bursa; SGMe: Subgluteus Medius Bursa; SGMi: Subgluteus Minimus Bursa; OIB: Obturator Internus Bursa; IG: Ischiogluteal Bursa

HOF: Head of Femur; IS: Ischial Spine; IT: Ischial Tuberosity; OI: Obturator Internus; GMax: Gluteus Maximus; GMed: Gluteus Medius; GMin: Gluteus Minimus

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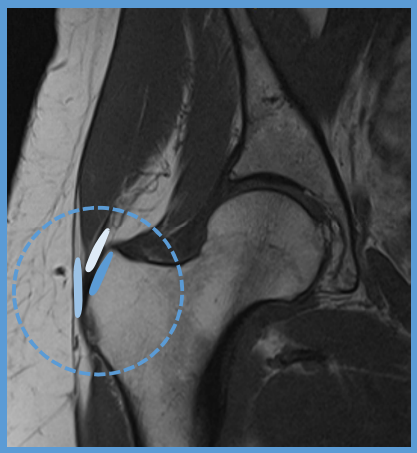
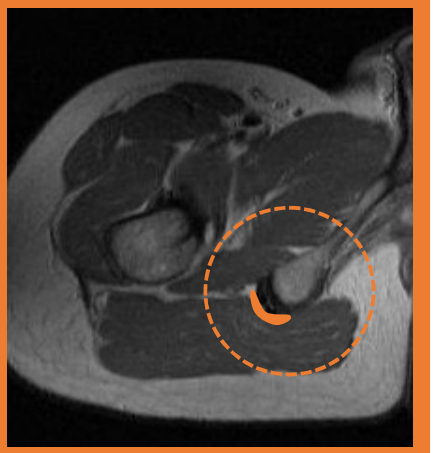
Focus Topics

Soft Tissue Related Greater Trochanteric Pain



Soft Tissue Related Ischial Pain



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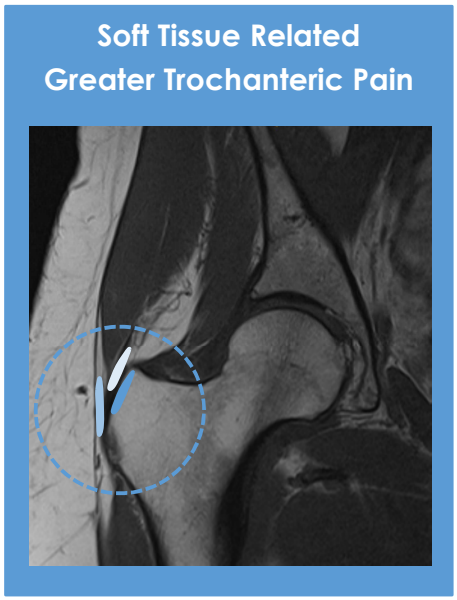
LATERAL HIP & BUTTOCK PAIN
Soft Tissue Related Pain
Greater Trochanteric Pain - Part 1

Module 2 – Lesson 2



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Soft Tissue Related Pain: GT Related Pain

- WHAT? → Sources of Nociception
- WHY? → Mechanisms
- HOW? → Clinical Indicators
- → Management

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Greater Trochanteric Pain

High prevalence in post menopausal women

Most common lower limb tendinopathy in GP

Mod-high pain levels

Sleep deprivation

Reduced activity

Levels of disability & QOL similar to end stage hip OA
(Fearon et al 2014)

Need:
Early Dx
Optimal Mx

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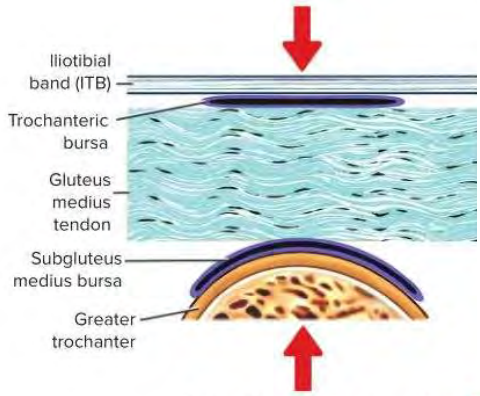
Pathoaetiological Mechanisms

Adaptation to tension

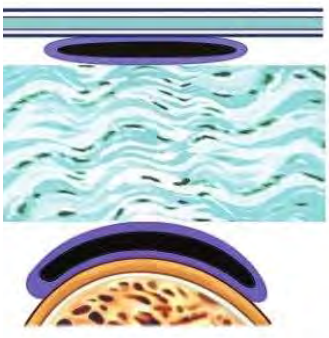
Adaptation to compression



ITB thickening
Bursal distention

Production of larger hydrophilic proteoglycans

Shift to cartilage like cells



Excessive compression → **Tensile loading capacity reduced**

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Almekinders et al 2003, Cook & Purdam 2011

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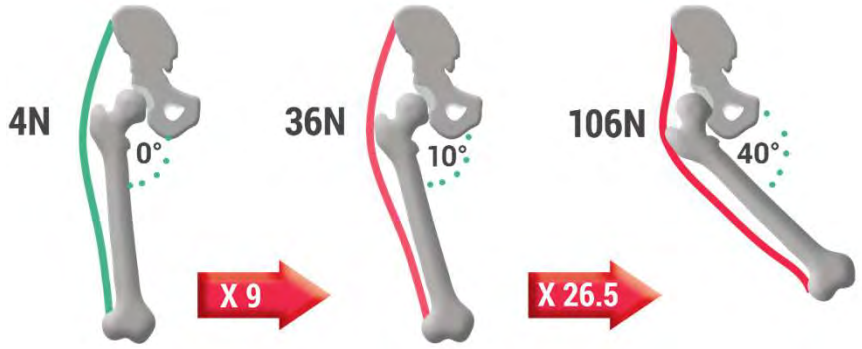
Potential mechanisms for aetiology & pain provocation for gluteal tendinopathy



Hip Adduction

ITB *wraps around greater trochanter like a pulley*

High compressive & tensile loads, particularly with muscle active in outer range

Birnbaum et al 2004

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Case Study: Meet Trish

55 year old female
Post menopausal
BMI 27

Lateral Hip Pain
Duration >12 months
Intensity 5/10
Frequency 60% time

Sleep deprivation
Reduced activity levels

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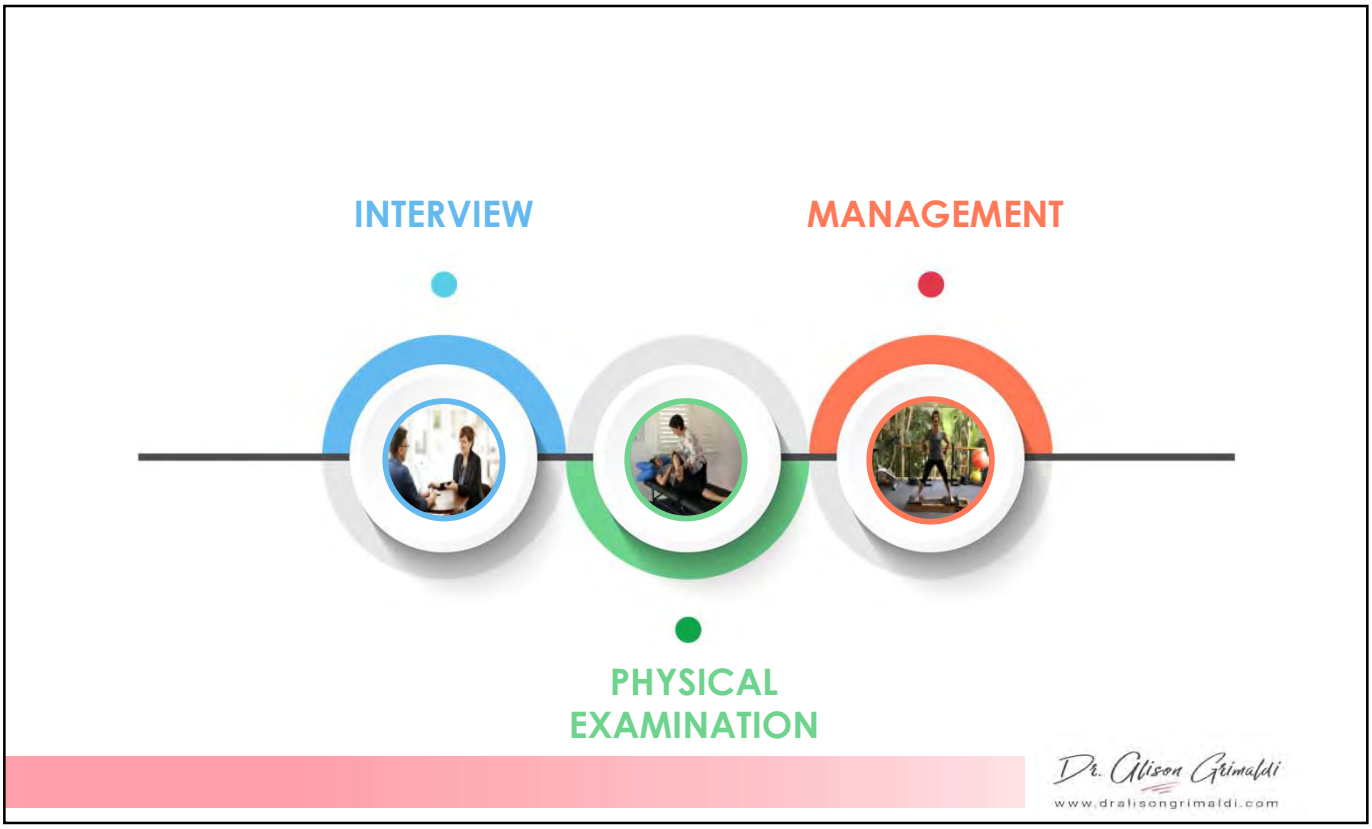

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3 Most Likely Sources of Lateral Hip Pain

1	2	3
Gluteal Tendons	Hip Joint	Lumbar Spine
(+/- assoc soft tissues *Bursae)		

Kingzett-Taylor et al 1999, Bird et al 2001, Connell et al 2003, Pfirrmann et al 2005, Kong et al 2006, Silva et al 2008, Fearon et al 2010, Long et al 2013

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Key Interview Features

1 Gluteal Tendon	2 Hip Joint	3 Lumbar Spine
Worst pain over greater trochanter	'C Sign' pain, superior to GT	Pain emanates from Lx or buttock

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Key Interview Features

1 Gluteal Tendon	2 Hip Joint	3 Lumbar Spine
Worst pain over greater trochanter	**'C Sign' pain, superior to GT**	**Pain emanates from Lx or buttock**
Hip stiffness not common feature	Hip stiffness common feature	Hip stiffness not common feature
Pain over GT in sidelying	General hip ache with sidelying	Pain more commonly worst in supine/prone
Pain over GT with single leg loading	Groin/C Sign pain with deep flexion	Back &/or radicular pain with prolonged sitting, standing, bending lifting

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Key Physical Features

1 Gluteal Tendon	2 Hip Joint	3 Lumbar Spine
Active Lx ROM ✓ Mild GT P with LF	Active Lx ROM ✓ May have P EOR F/E	Active Lx ROM * Ext/Rot, SLR, Slump
Hip ROM ✓	Restricted hip flexion/IR *	Hip ROM ✓
TOP over GT *	May have some TOP over GT	TOP Lx
Pain over GT reproduced on specific tests *	Deep anterior hip P on FADDIR, Scours/Quadrant *	No local hip P reproduced on physical hip tests ✓



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Utility of clinical tests to diagnose MRI-confirmed gluteal tendinopathy in patients presenting with lateral hip pain

Alison Grimaldi,[1,2] Rebecca Mellor,[2] Phillipa Nicolson,[3] Paul Hodges,[4] Kim Bennell, Bill Vicenzino[2,4]

ABSTRACT

Purpose Gluteal tendinopathy (GT) is a source of lateral hip pain, yet common clinical diagnostic tests have limited validity. Patients with GT are often misdiagnosed, resulting in inappropriate management, including surgery. This study determined the diagnostic utility of clinical tests for GT, using MRI as the reference standard.

test could convincingly predict findings from MI The test with most promise was the resisted ex nal de-rotation test from a hip flexed and extern rotated position. This test is designed to stress gluteal tendons by longitudinal (tensile) and c pressive loads.[10] Limitations of previous stu assessing diagnostic utility of clinical tests v identified in Reiman *et al*'s[9] systematic review.

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BJSM Online First: 2016 September 15
In Print: 2017 Mar;51(6):519-524

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Most Useful Tests

Most useful for **Ruling out GT**

PALP
-LR: 0.4
Acc: 72%

Tests that involve a muscle contraction
Most useful for **Ruling In GT**

SLS	**FADER-R**	**ADD-R**
+LR: 12.2	+LR: 6.6	+LR: 5.7
PPV:100	PPV:96	PPV:95

Useful for **DDX Hip OA v GT**
Fearon et al 2013

FABER

Grimaldi et al 2017

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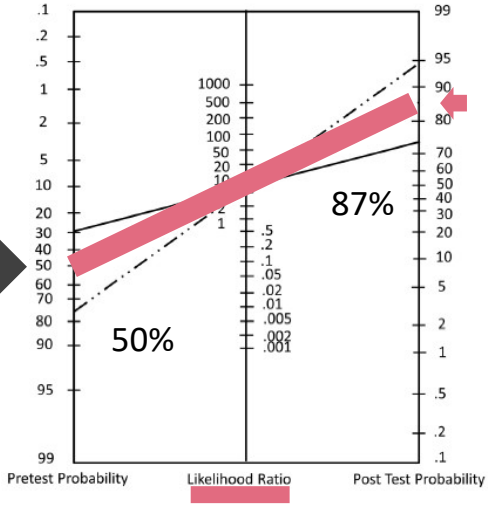
Trish:
55 yo post menopausal female
Lateral hip pain in sidelying and single leg tasks



Grimaldi et al 2017

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Do we need to order imaging?

NO
Positive clinical tests
No red flags

YES
Negative on physical tests for MSK cause

Red flags

Persistent pain despite course of evidence-based management

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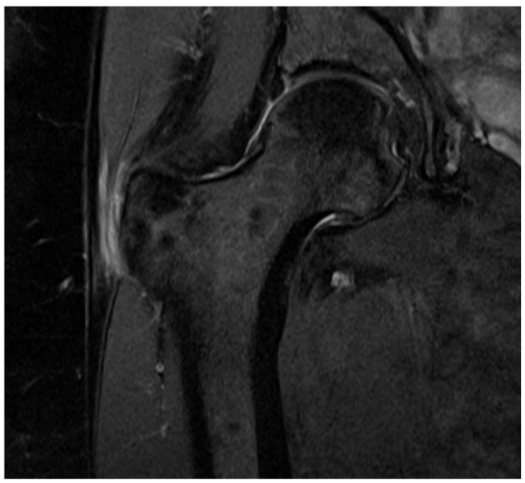
Interpreting imaging results



-ve on clinical tests
➡ Consider other differential diagnoses

+ve MRI alone should not be used as a basis for intervention

+ve MRI may occur in those without clinical signs or symptoms of gluteal tendinopathy

Blankenbaker et al 2008, Grimaldi et al 2017

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Trish's examination findings


FADER-R
+ve


SLS
+ve


PALP
+ve


FADDIR
-ve

Diagnosis of Gluteal Tendinopathy

What does the evidence support as best management?

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What would you recommend as first-line management for Trish?

a. Wait & See?
b. Education & exercise? What type?
c. Corticosteroid Injection?
d. PRP Injection?
e. None of the above?

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Soft Tissue Related Pain: GT Related Pain

WHAT? → Sources of Nociception
WHY? → Mechanisms
HOW? → Clinical Indicators
→ Management

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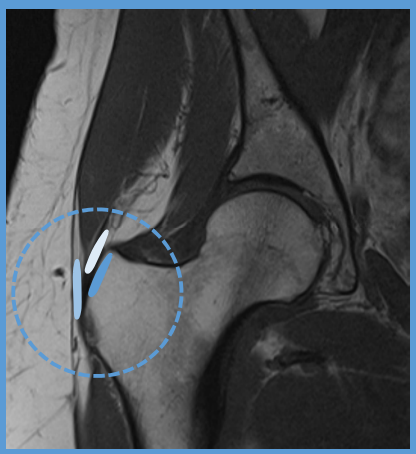
LATERAL HIP & BUTTOCK PAIN
Soft Tissue Related Pain
Greater Trochanteric Pain- Part 2

Module 2 – Lesson 3

Soft Tissue Related Greater Trochanteric Pain



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Soft Tissue Related Pain: GT Related Pain

WHAT? → **Sources of Nociception**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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What would you recommend as first-line management for Trish?

a. Wait & See?

b. Education & exercise? What type?

c. Corticosteroid Injection?

d. PRP Injection?

e. None of the above?

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RESEARCH

OPEN ACCESS

the bmj

Education plus exercise versus corticosteroid injection use versus a wait and see approach on global outcome and pain from gluteal tendinopathy: prospective, single blinded, randomised clinical trial

Rebecca Mellor,[1] Kim Bennell,[2] Alison Grimaldi,[3] Philippa Nicolson,[2] Jessica Kasza,[4] Paul Hodges,[5] Henry Wajswelner,[6] Bill Vicenzino[1]

[1]School of Health and Rehabilitation Sciences, University of Queensland, QLD 4072, Australia
[2]Centre for Health, Exercise and Sports Medicine, Department of Physiotherapy, University of Melbourne, Carlton, VIC, Australia
[3]Tarragindi, QLD, Australia
[4]Epidemiology and Preventive Medicine, Alfred Centre, Monash University, Melbourne, VIC, Australia
[5]National Health and Medical Research Council (NHMRC), Centre of Clinical Research

ABSTRACT

OBJECTIVE
To compare the effects of a programme of load management education plus exercise, corticosteroid injection use, and no treatment on pain and global improvement in individuals with gluteal tendinopathy.

DESIGN
Prospective, three arm, single blinded, randomised clinical trial.

SETTING
Brisbane and Melbourne, Australia.

PARTICIPANTS
Individuals aged 35-70 years, with lateral hip pain for

RESULTS
Of 204 randomised participants (including 167 women; mean age 54.8 years (standard deviation 8.8)), 189 (92.6%) completed 52 week follow-up. Success on the global rating of change was reported at eight weeks by 51/66 EDX, 38/65 CSI, and 20/68 WS participants. EDX and CSI had better global improvement scores than WS (risk difference 49.1% (95% confidence interval 34.6% to 63.5%), number needed to treat 2.0 (95% confidence interval 1.6 to 2.9); 29.2% (13.2% to 45.2%), 3.4 (2.2 to 7.6); respectively). EDX had better global improvement scores than CSI (19.9% (4.7% to 35.0%); 5.0 (2.9 to 21.1)). At eight weeks, reported pain on the numerical

the bmj | BMJ 2018;361:k1662 | doi: 10.1136/bmj.k1662
Published online May 2nd 2018

LEAP TRIAL

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LEAP TRIAL

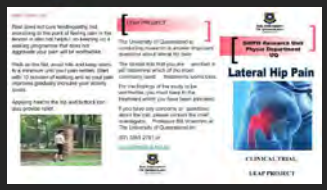
Phone screen (n=1691)
↓
Physical screen (n=421)
↓
MRI / Xray (n=248)
↓
Randomisation (n=204)

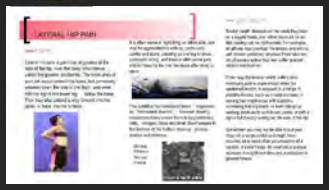
EDX (n=69) | CSI (n=66) | W&S (n=69)

Demographics:

54.8 (8.8) years old
167 (82%) female
27.5 (5.1) kg/m^2
Pain severity 4.9 (1)
Median Pain Duration: 24/12

14 sessions in 8/52
Supervised Exercise + HEP
Adherence 90%





Basic Advice

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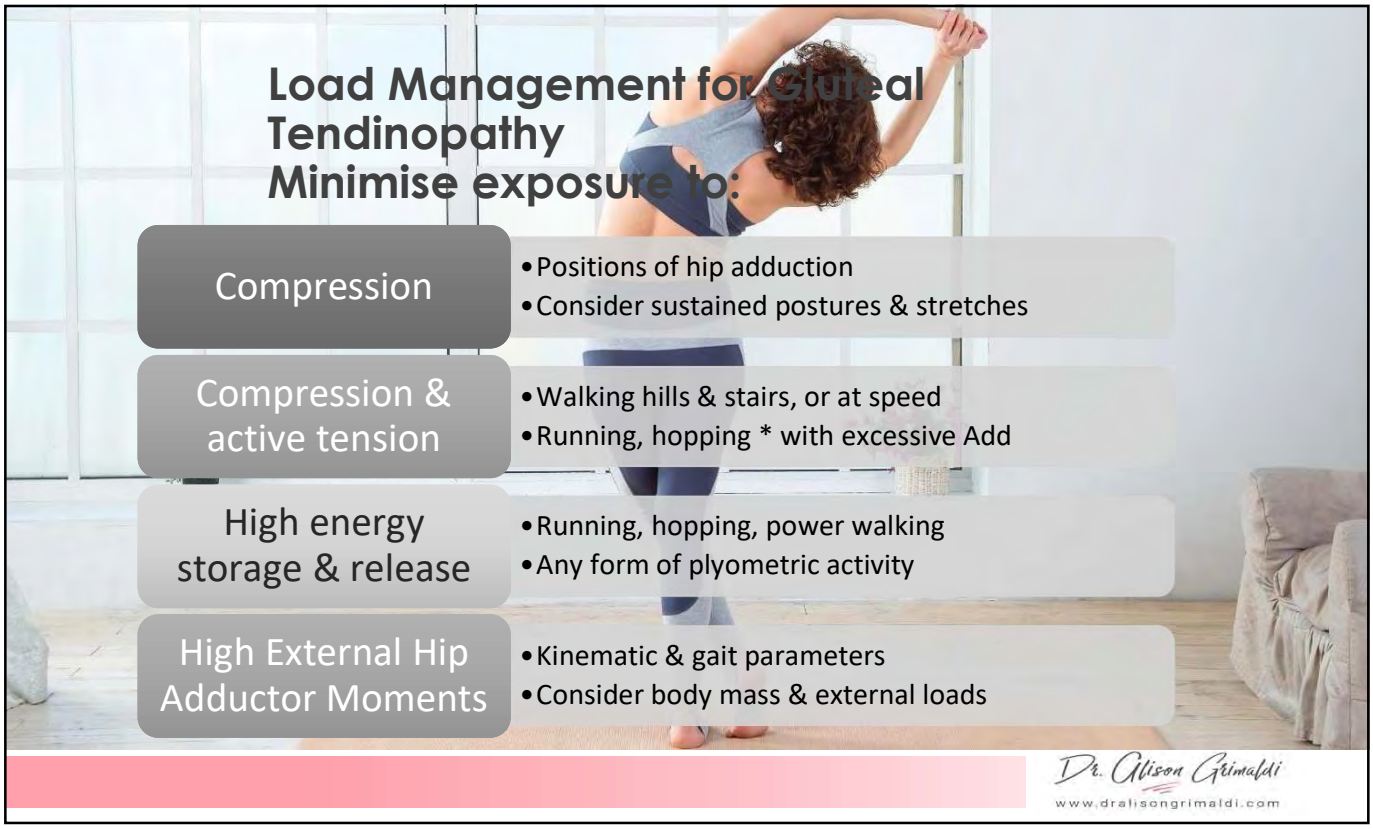
Load Management for Gluteal Tendinopathy
Minimise exposure to:
Compression
•Positions of hip adduction
•Consider sustained postures & stretches
Compression & active tension
•Walking hills & stairs, or at speed
•Running, hopping * with excessive Add
High energy storage & release
•Running, hopping, power walking
•Any form of plyometric activity
High External Hip Adductor Moments
•Kinematic & gait parameters
•Consider body mass & external loads
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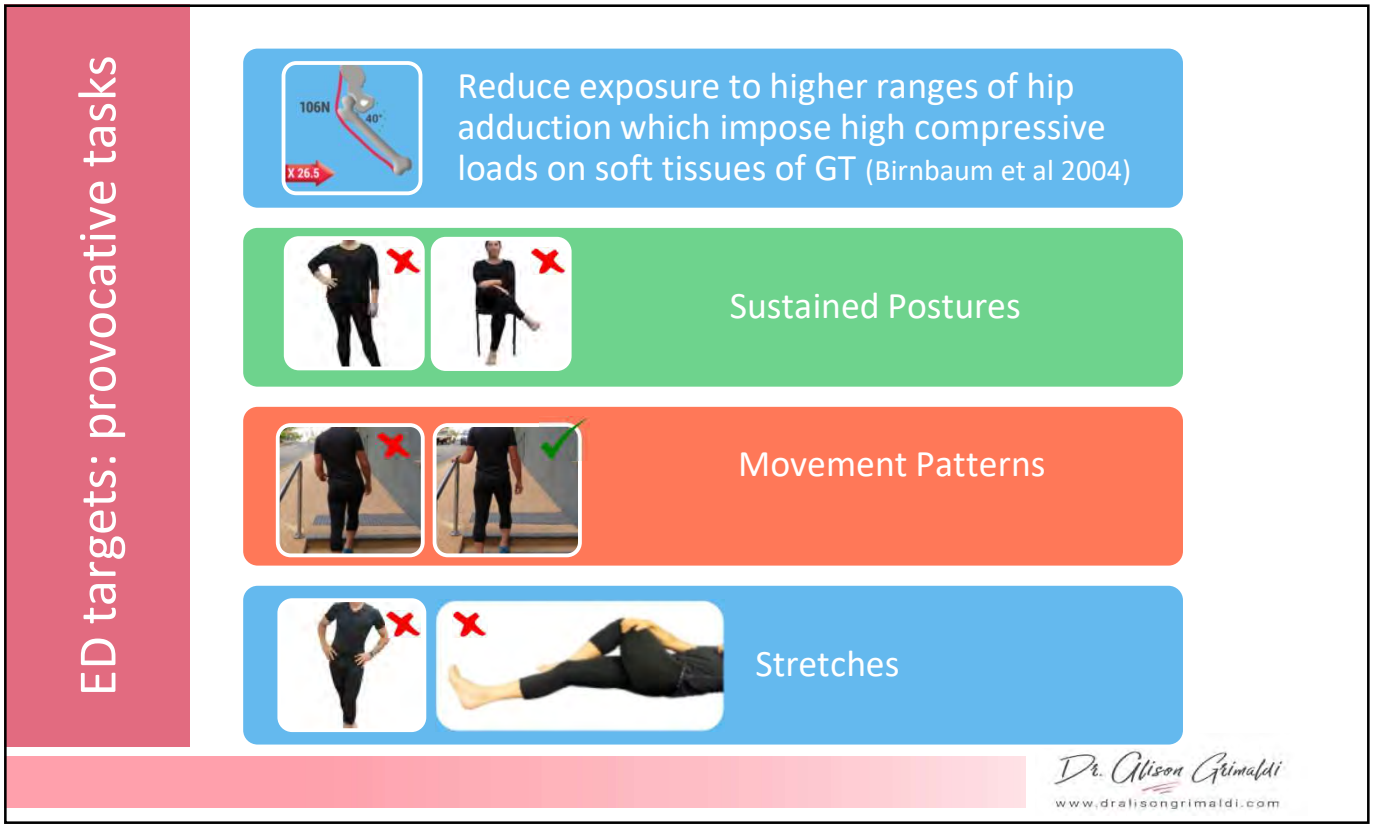
ED targets: provocative tasks
106N
40°
X 26.5
Reduce exposure to higher ranges of hip adduction which impose high compressive loads on soft tissues of GT (Birnbaum et al 2004)
Sustained Postures
Movement Patterns
Stretches
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EX targets: known impairments

Fatty atrophy of GMed & GMin

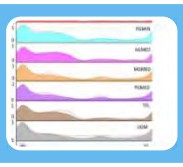
Pfirrman et al 2005, Sutter et al 2013, Woodley et al 2008

Hip abductor muscle weakness
23 -32% weaker than painfree population

Allison et al 2016a, Ganderton et al 2017

Kinematic & kinetic impairments
Altered frontal plane control & abductor loads

Allison et al 2016b,c,d



Altered abductor muscle recruitment strategies
Excess co-contraction, loss of precision & load sharing

Allison et al 2018, Ganderton et al 2017

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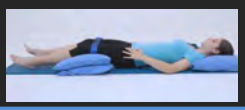
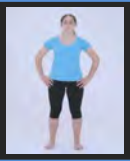
Progressive, Pain Monitored

Isometric Abduction





Bridging progressions

Functional Loading

Targeted Abductor Loading

X 2

X 1

Heavy Slow Loading 3x/wk
External Resistance
Into Inner Range
RPE: Hard – Very Hard

the bmj | BMJ 2018;361:k1662 | doi: 10.1136/bmj.k1662 **Details in the Supplement**

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Primary Outcomes

Global Rating of Change

- Very much better
- Much better
- Moderately better
- Somewhat better
- Slightly better
- Same
- Slightly worse
- Somewhat worse
- Moderately worse
- Much worse
- Very much worse

Pain Severity Numerical Rating Scale

10 WORST PAIN IMAGINABLE
9
8
7
6
5
4
3
2
1
0 NO PAIN

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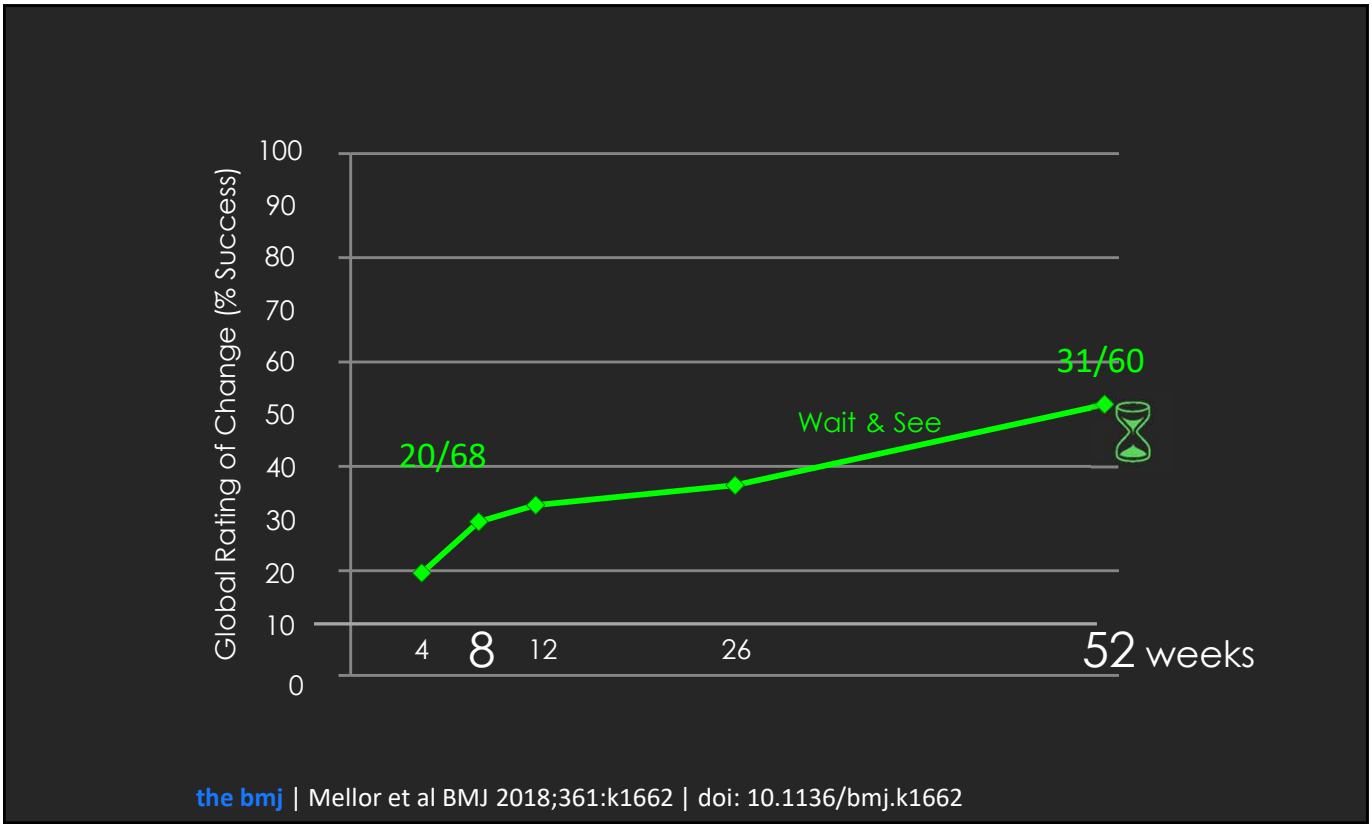

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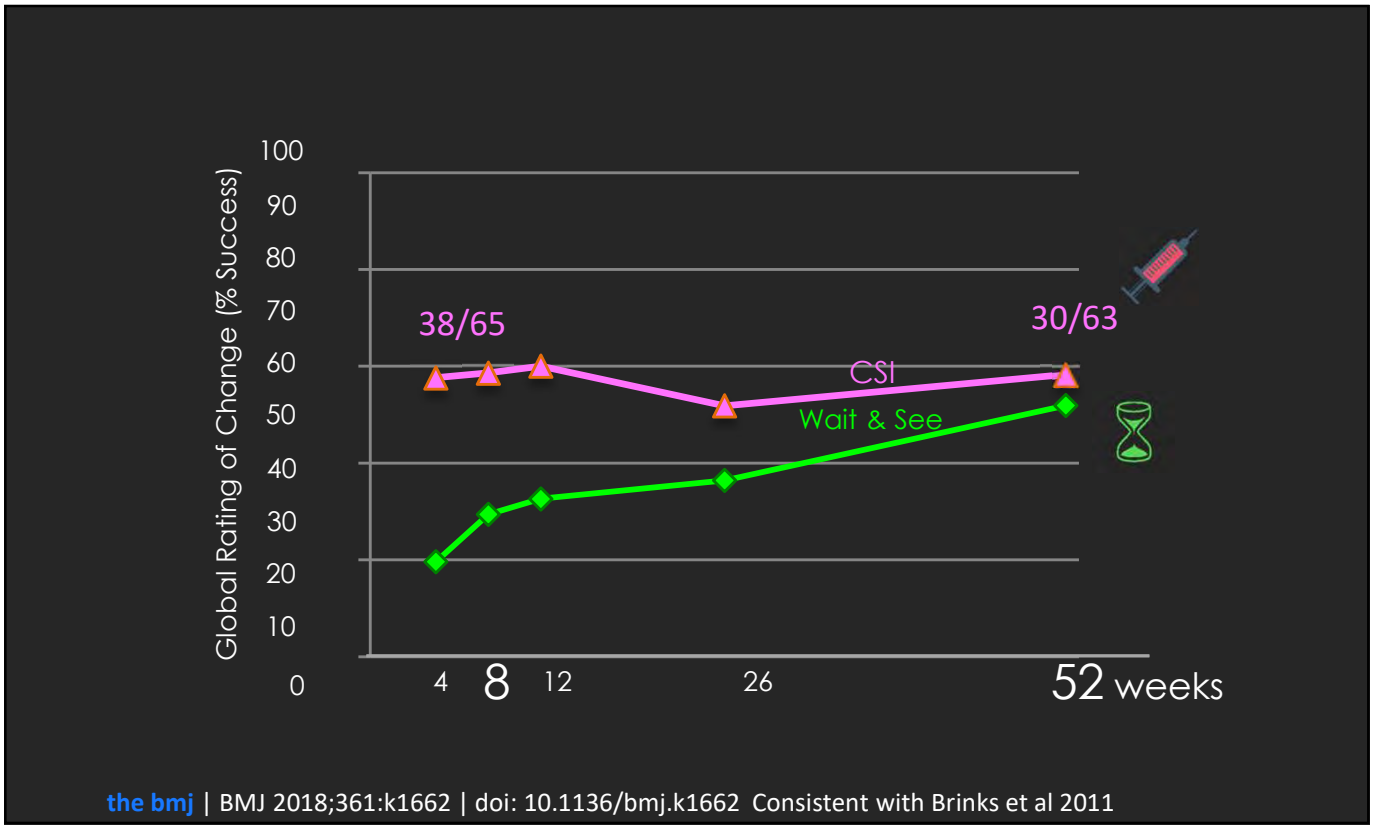

the bmj | BMJ 2018;361:k1662 | doi: 10.1136/bmj.k1662 Consistent with Brinks et al 2011

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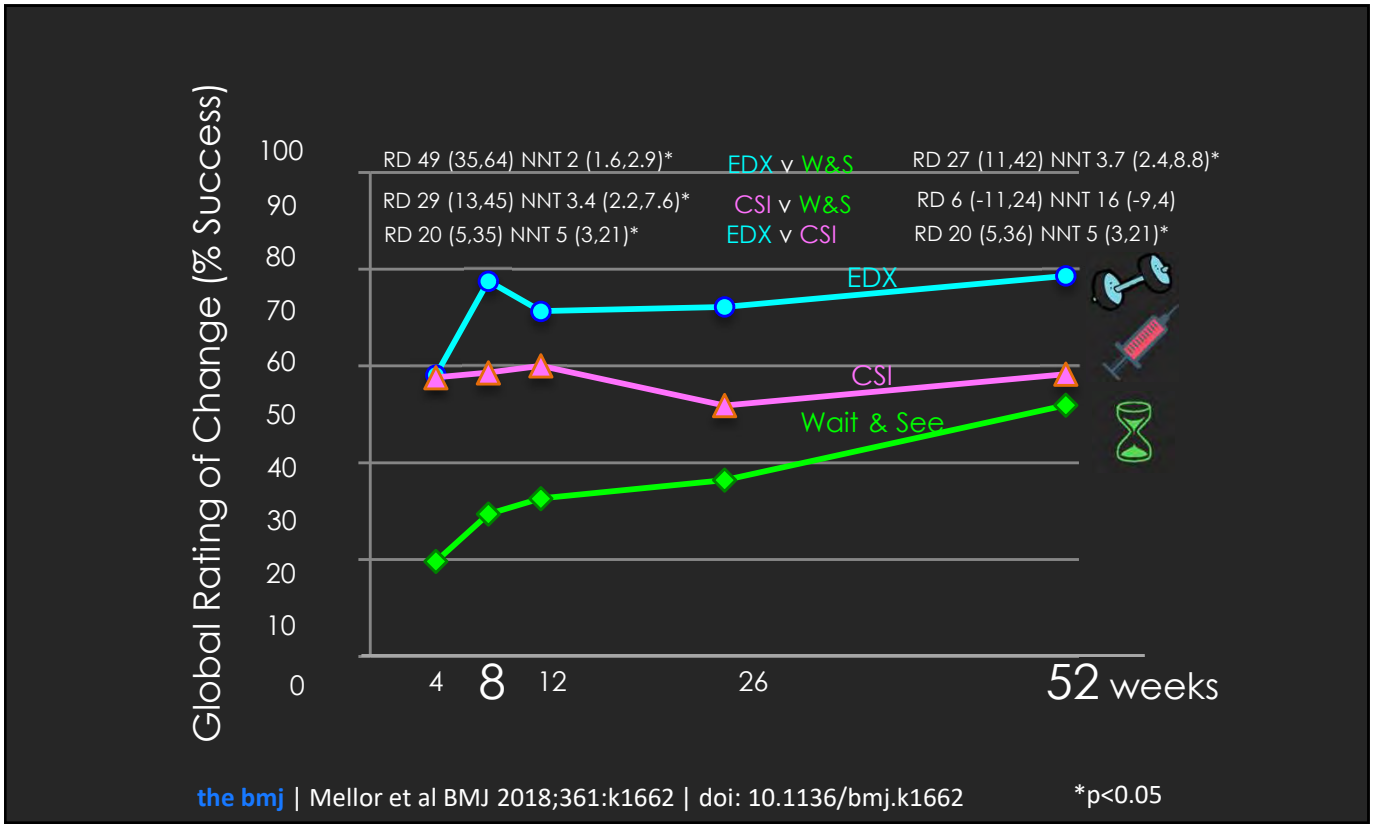

the bmj | Mellor et al BMJ 2018;361:k1662 | doi: 10.1136/bmj.k1662 *p<0.05

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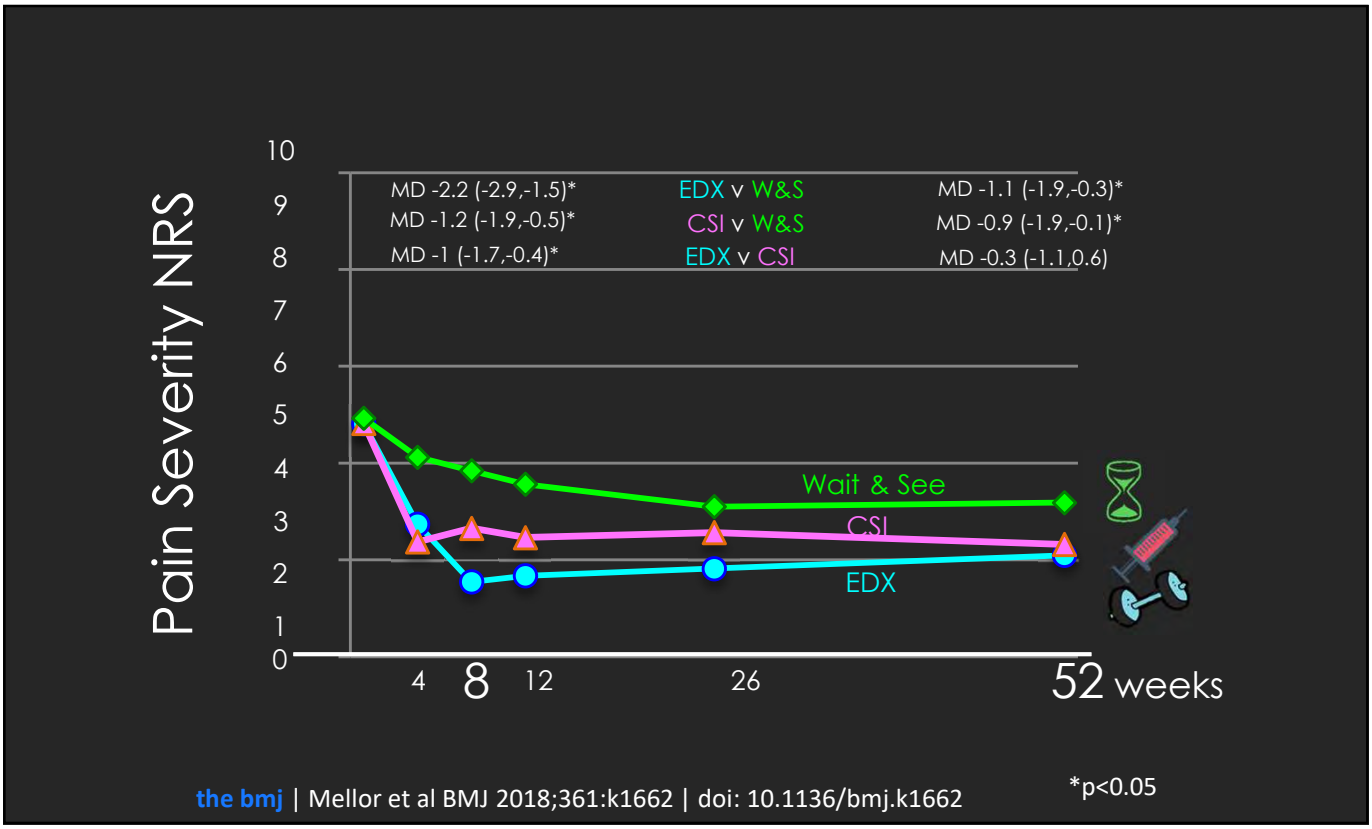

the bmj | Mellor et al BMJ 2018;361:k1662 | doi: 10.1136/bmj.k1662

*p<0.05

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Insights from secondary analyses

Success is not just about pain severity

EDX

→ *less Pain Constancy*

→ *better QoL*

than both W&S & CSI

QOL = Quality of Life (EQ-5D)

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GLoBE Trial – Exercise vs Sham Exercise

GLoBE Exercise protocol:

Stage 1:
Standing hip hitch
Bilateral wall squat
Bilateral calf raise

Stage 2:
Standing h
Bilateral sit
Bilateral c

Stage 3:
Standing h
Offset sit-st
Unilateral

Stage 4:
Single leg wall squat
Step up
Unilateral calf raise

Sham Exercise protocol:

Stage 1:
Seated gluteal squeezes
Supine knee IROE over roll
Seated single leg calf raise

Stage 2:
ction
e

inst wall
d theraband
aps

Stage 4:
Standing trunk LF, back against wall
Seated knee extension – green theraband
Seated calf raises with pulses up/down

Both groups improved
No difference between groups

Education + GLoBE Exercise vs **Education + Sham Exercise**

Ganderton et al 2018

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Parameter	W & S	LEAP EDX	GLoBE EDX
% Success	52%	78%	54%
% Imp on Visa G 3/12	4.6%	19.1%	11.5%
Education	Basic	Comprehensive	Comprehensive
Exercise	Nil	Weightbearing	Weightbearing
		No stretching	No stretching
		2+1x wk heavy loading	No heavy loading
		Inner range Abd	No inner range Abd
Adherence	N/A	90%	76%
Movement Re-ed	Nil	Re-ed of posture, gait & stairclimbing	No specific retraining
F2F sessions	1	14	4

Ganderton et al 2018

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Home Training, Local Corticosteroid Injection, or Radial Shock Wave Therapy for Greater Trochanter Pain Syndrome

Compression

Non-randomised clinical trial
12 weeks of exercise bd including:
1. Piriformis stretch
2. ITB standing stretch
3. Active SLR
4. Double leg ball squat
5. Prone Hip Extension

No ABD loading

		Baseline	1/12	4/12	15/12
HEP	Pain /10	6.2	5.9	5.2	2.7
	%pts improved		6.6%	40.8%	80.2%
CSI	Pain /10	5.8	2.2	4.5	5.3
	%pts improved		74.7%	50.6%	48%
SWT	Pain /10	6.3	5.6	3.2	2.4
	%pts improved		12.8%	67.9%	74.3%

Rompe et al 2009

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The effectiveness of PRP in Gluteal Tendinopathy

CSI vs PRP
with Advice & Ex

CSI n=40 Baseline mHHS:54.15	**PRP n=40** Baseline mHHS:53.77
US Guided, Intratendinous	US Guided, Intratendinous
mHHS @3/12 = 67/100	mHHS @ 3/12 = 74/100
Significant between Gp difference - 7pts; MCID = 8	
60% Bursitis *only*	50% Bursitis *only*
12 week unsupervised exercise programme	
Education: Load management, progressive RT activity	

Fitzpatrick et al 2018

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The effectiveness of PRP in Gluteal Tendinopathy

CSI vs PRP
with Advice & Ex

Lack of control group & inclusion of load management education and an exercise programme makes it difficult to determine true effect of injections

50-60% of participants did not have tendinopathy

Rationale for intratendinous PRP & CSI in normal tendons?

mHHS (OA score)may overestimate hip-related function in GTPS patients in comparison to VISA-G (Fearon et al 2015)

Evidence for PRP remains unclear

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What advice do we give Trish?

Try an education & exercise approach first

Making simple changes may be very helpful

An active approach is likely to be most useful in addressing impairments

The addition of CSI is unlikely to add further benefit

Benefit of PRP unclear

Exercise intervention likely to be more successful under guidance of a physio (at least in early stages & for those with significant impairments)

EDX will be optimally effective with high levels of compliance.

If you don't do it, it won't work!

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For more reading on this topic, you might also like the online ebook on this topic

Visit
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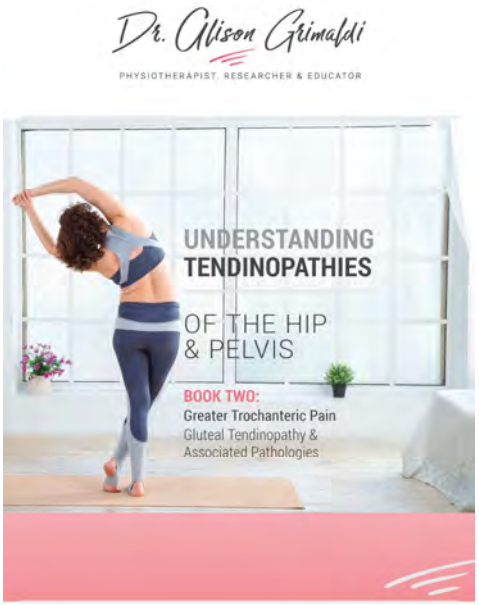

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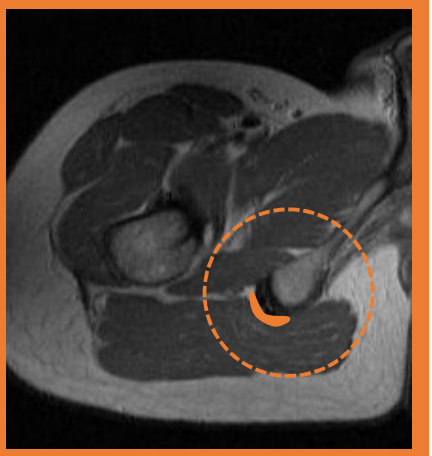
LATERAL HIP & BUTTOCK PAIN
Soft Tissue Related Pain
Muscle, Fascia, Tendon, Bursa

Module 2 – Lesson 4

Soft Tissue Related Ischial Pain



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Soft tissue related ischial pain

Soft tissue conditions associated with ischial pain:

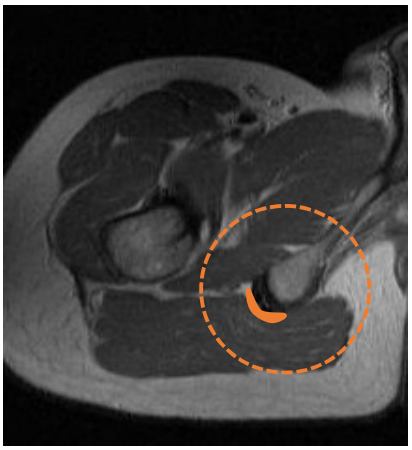
Proximal Hamstring Tendinopathy/Tear

Ischiogluteal Bursitis

Neuralgia
- Sciatic (ischial tunnel)
- PFCN - Inferior cluneal nerve

(Refer to Nerve Related Pain)

Axial MRI at ischial level



Also consider:

Lumbar spine

SIJ

In adolescents:

Ischial apophysitis /avulsion

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The ischiogluteal bursa

Covers the proximal hamstring tendons

Sits between tendons & gluteus maximus

Adventitial bursa – not present in everyone

Isn't usually visible on imaging unless enlarged

Axial MRI at ischial level

GMax: Glutues maximus muscle; IT: Ischial Tuberosity; PHT: Proximal Hamstring Tendons; Orange Crescent: Ischiogluteal bursa

Ripani et al 2006, van Mieghem et al 2004

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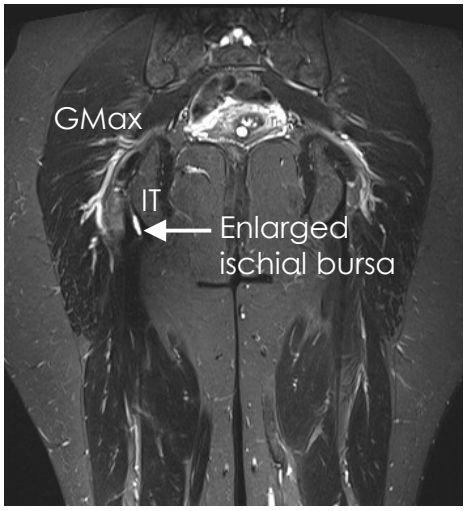
Ischiogluteal bursitis

Coronal MRI



May become a source of nociception due to:

Systemic inflammatory disease

Infection
Neoplasm
(Ask GH questions, listen for reports of fever, look for swelling, feel for heat)

Mechanical factors
- Acute trauma - Fall onto ischium
- Sitting on firm surfaces -Weaver's bottom
+ vibration/motion – machinery/sport

Cho et al 2004, Dierckman & Guanche 2012, Kim et al 2002

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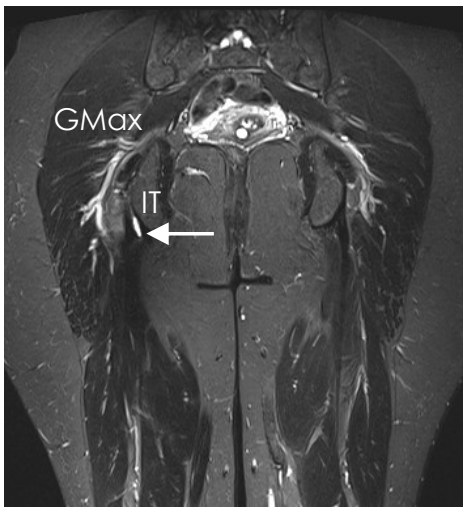
Ischiogluteal bursitis

Coronal MRI



Other related factors
- some have low body mass with poor padding over ischium
- those with paraplegia at risk, esp endurance athletes

Coexisting pathologies
- proximal hamstring tendinopathy
- neuralgia – sciatic or posterior femoral cutaneous nerves

Cho et al 2004, Márquez-Arabia 2018

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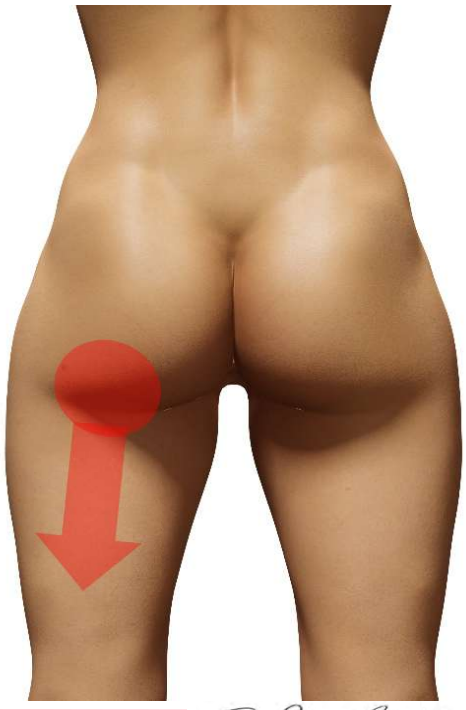
Key Interview Features

***Pain over Ischium**
+/- post thigh pain
+/- SN/PFCN symptoms
(if assoc nerve entrapment)

Pain with:
Sitting *hard surfaces
Lying supine
Hip flexion, forward lean activities
(actions that increase tension in overlying gluteus maximus)
Pain often worst at rest or at night rather than during activity



Cho et al 2004, Márquez-Arabia 2018, Mills & Bathge 1993

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Key Physical Features

***Reproduction of patient's ischial pain on**
- Glute max stretch or contraction or both
- Compression of bursa – FABER, palpation

Note any visible swelling or palpable warmth

Hip Flexion
+ resisted hip extension

HCLK Test
(Heel Contra-Lateral Knee)

FABER
(GT-Ischial Impingement)

Tenderness on palpation of ischium

Hitora et al 2009, Márquez-Arabia 2018, Mills & Bathge 1993

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Ischiogluteal bursitis – Differential Diagnosis

If there is visible swelling &/or palpable warmth
- Has there been an acute trauma? – haemorrhage? (avulsion?)
- Co-existing fever, feeling unwell – consider infection
- No apparent mechanical driver – consider systemic illness, neoplasm

➡ Recommend referral for medical review

Bursitis related to repetitive mechanical factors
- Less likely to be visible swelling or palpable warmth
- May co-exist with adjacent pathologies/sources of nociception

➡ Imaging required for firm diagnosis – MRI or US
but only if findings are likely to alter Mx

Ax for alternate/coexisting sources – PHT, DGS, Lx, SIJ, hip joints

Ax: Assessment; PHT: Proximal Hamstring Tendinopathy; DGS: Deep Gluteal Syndrome; Lx:Lumbar Spine; SIJ: Sacroiliac Joints

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Management of Ischiogluteal bursitis

Acute Trauma
- Relative rest, ice, compression shorts as tolerated
- Minimise adhesions – gluteal contractions, hip motions, nerve gliding

Repetitive Loading
- Cushion for sitting, address seating in seated athletes
- Address volume of provocative position/activity – Sit-stand desk; training schedule, types of activities
- Address any associated impairments

Medical Management for bursitis related to mechanical loading
- Pharmacological: NSAIDs, Injection – LA/CSI
- Surgical debridement- early rehab important to avoid problematic adhesions

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Key Interview Features

How does it present?

Pain over Ischium

+/- post thigh pain or tightness

+/- SN symptoms (assoc ischial tunnel entrapment)

Pain with:
Sitting *hard surfaces
Stairs
Walking/running uphill
Running higher speeds
Forward lean activities

Impact:
Functional limitations associated with sitting can be substantial – work & social
Reduced activity levels
Reduced sporting performance

Most common in:
Runners, Dancers, Yoga, Hockey
Also older males & post menopausal women

Fredericson 2005, Lempainen et al 2009, 2015, Nicholson et al 2016

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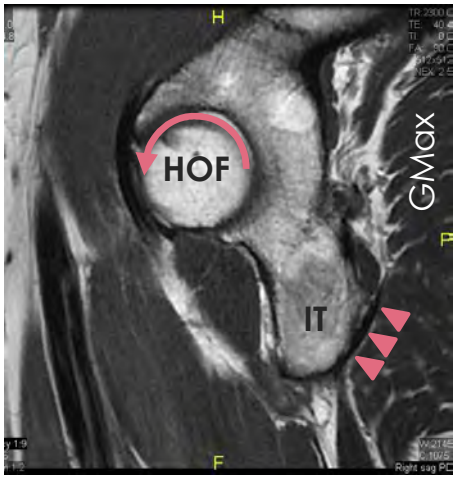
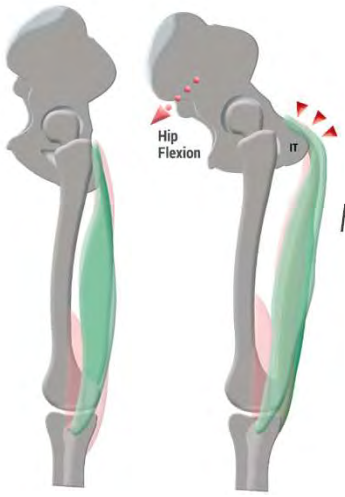
Potential mechanisms for aetiology & pain provocation for proximal hamstring tendinopathy





Hip Flexion
Tendon wraps around Ischium like a pulley

High compressive & tensile loads, particularly with muscle active in outer range

Cook & Purdam 2012, Soslowsky et al 2002

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Common sources of compression







Hip Flexion

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Proximal Hamstring Tendon Origins

BFLH: Biceps Femoris Long Head; ST: Semitendinosis: SM: Semimembranosis; CJ: Conjoint Tendon - Combined insertion of BFLH & ST

Benazzo et al 2013, Bowman et al 2013, Lempainen et al 2015

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Key Physical Features

Clinical Test Battery

Palpation (Tenderness prox hams insertion) +

Puranen Orava Test

Heel Drag

Shoe Off test

M/Bent Knee Stretch

+ve Test = reproduction of pain at ischial tuberosity
+/- into prox hams

Bowman et al 2013, Cachio et al 2013, Reiman et al 2013

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Pain on Loading – Load Tolerance Tests

Graduated load tolerance tests can be useful clinically to monitor progression

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Recognising proximal hamstring tendon avulsion

PHT Avulsion: Typical clinical findings

- Trauma mechanism: Forced hip F + Kn Ext
- Tearing or popping sensation
- Severe pain, sitting is painful
- Severe loss of function, walking is difficult
- Extensive posterior thigh bruising
- Pain on palpation – IT & area of bruising
- Palpable loss of bone-tendon continuity during resisted knee flexion

PHT Avulsion: Atypical clinical findings

- Trauma mechanism: Hip abd, not flexion
- Bruising subtle or absent
- Loss of function (knee F) not complete
- ROM full/more than contralateral leg

Acute hamstring strain injury

- Trauma mechanism often involves high-speed sprinting
- Mild loss of function
- Bruising is limited if present
- Pain on palpation of muscle belly
- Range of motion is reduced

van der Made et al 2018

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MANAGEMENT STRATEGIES

Non-Medical Management

Medical Management

Analgesics/NSAIDs
Injection therapy
- LA/CSI
- PRP

Surgery
- debridement
- release of SM tendon
- repair for avulsion

early rehab important to avoid problematic adhesions

Goom et al 2016, Benazzo et al 2013, Lempainen et al 2009

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Load Management for Proximal Hamstring Tendinopathy

Minimise exposure to:

Compression	•Positions of hip flexion esp with knee ext •Consider sustained postures & stretches
Compression & active tension	•Walking/running hills & stairs, or at speed •Forward lean tasks
High energy storage & release	•Running, bounding •Plyometric activity

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PROXIMAL HAMSTRING TENDINOPATHY
Load Management in Activities of Daily Living

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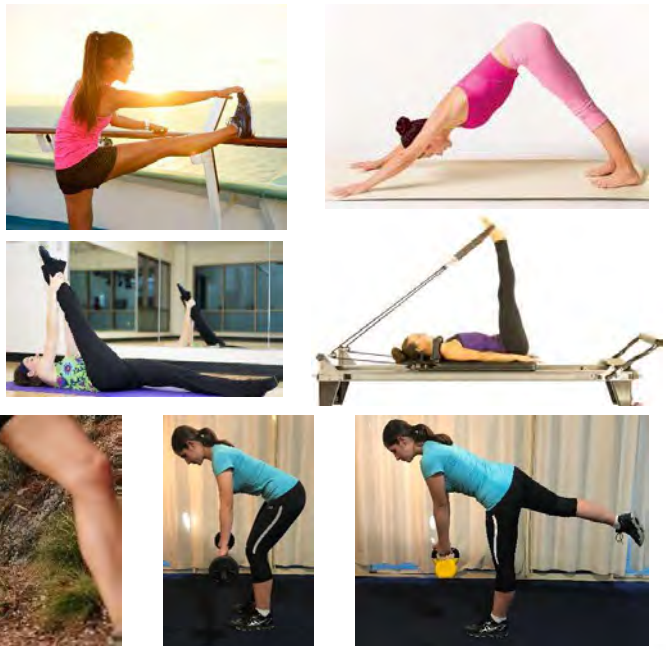
PROXIMAL HAMSTRING TENDINOPATHY

Load Management in Sport, Recreation



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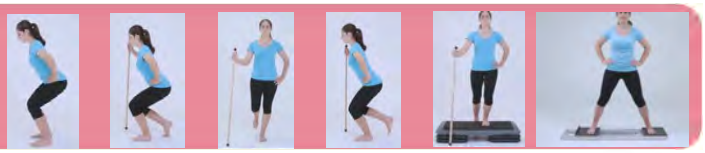
Exercise therapy for Proximal Hams Tendinopathy

Isometric Hamstrings (if useful for pain relief)

Bridging Progressions

Hamstring Curls

Kinetic Chain Strengthening



Gait training *runners

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Late stage rehab

Does late stage rehab need to progress the patient back to actions that involve highly compressive loads to ensure the patient is able to tolerate these loads?

What longer term loading program will maintain optimal tendon homeostasis?

Are positions of high compressive load an integral part of this individuals daily or sporting function?

Are there options to alter this?

If not, are high compressive load exercises necessary in the gym/rehab environment to 'adapt' the tendon back to these loads or should we be looking to balance the relative stimuli?

Goom et al 2016

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Balancing Mechanobiological Stimuli

Stiff Leg Deadlift
Hip Extension Machine with Straight Legs

Running/walking uphill/upstairs
Kicking
Forward lean to play hockey, gather a ball off the ground, perform a ballet or gymnastics manoeuvre
Emptying the dishwasher
Putting shoes on
Bending/lifting
Gardening/Cleaning
Forward lean at work

Heavy, slow tensile loads with low compression eg prone hamstring curls

Compression ***Tension***

Homeostasis

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For more reading on this topic, you might also like the online ebook on this topic

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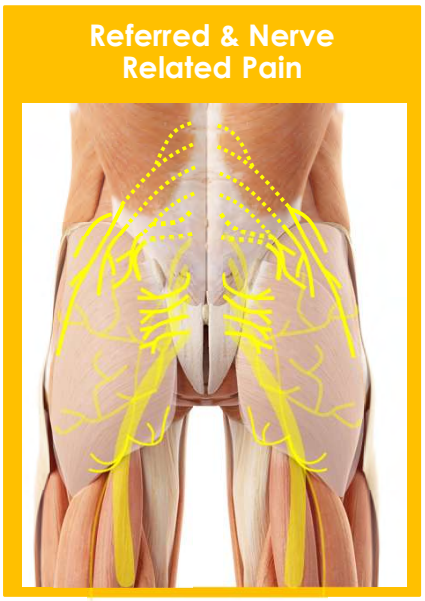

LATERAL HIP & BUTTOCK PAIN Referred & Nerve Related Pain

Module 3 – Lesson 1

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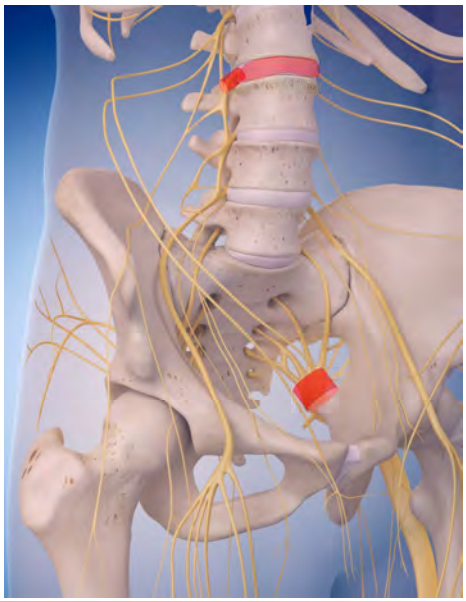
Referred & Nerve Related Pain



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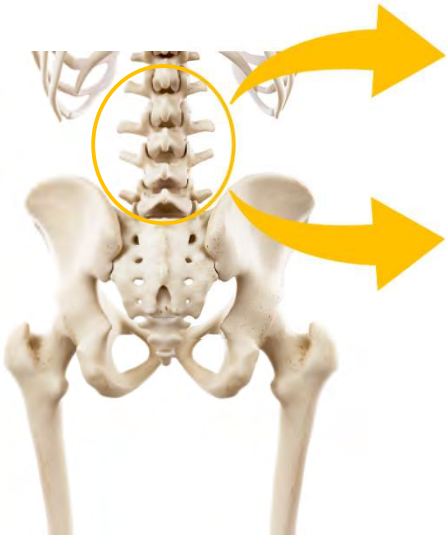
Lumbar spine related hip pain



Radicular Pain

Somatic Referred Pain

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Radicular Pain

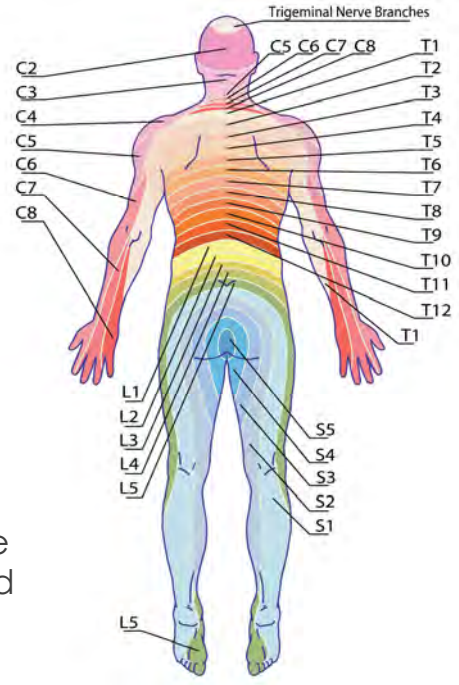
Arising from NR impingement/irritation
L3 – S2 main levels referring to region

Clinical Indicators

sharp, stabbing or shooting pains
+/- additional deep, dull ache
+/- tingling, itching, burning or numbness
+/- change in reflexes, motor function, bladder/bowel symptoms

Be Aware:

Up to 2/3 with entrapment neuropathy have symptoms that do not correlate with defined territorial distributions



Murphy et al 2009, Schmid et al 2018

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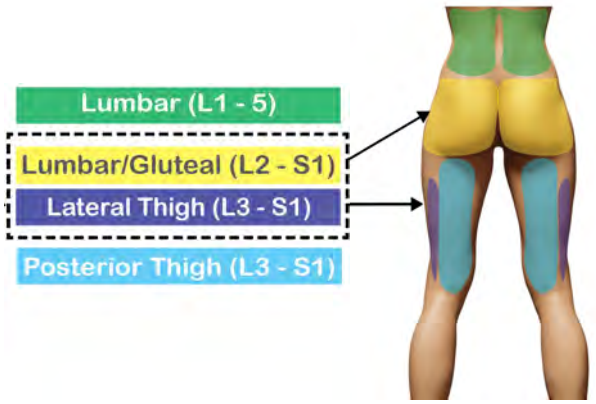
Somatic Referred Pain



- commonly reported as a dull, aching or gnawing pain
- area of pain often wide and difficult to localise
- not related to nerve root impingement, but other structures such as facet joints & IV discs
- if somatic only, not associated with nerve-related symptoms such as tingling or numbness

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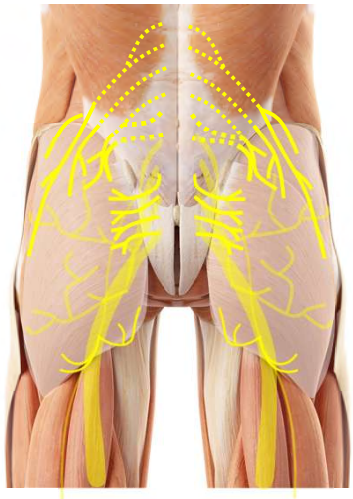
Local nerve related pain



Irritation or entrapment of local peripheral nerves that transit and serve the lateral hip or buttock region

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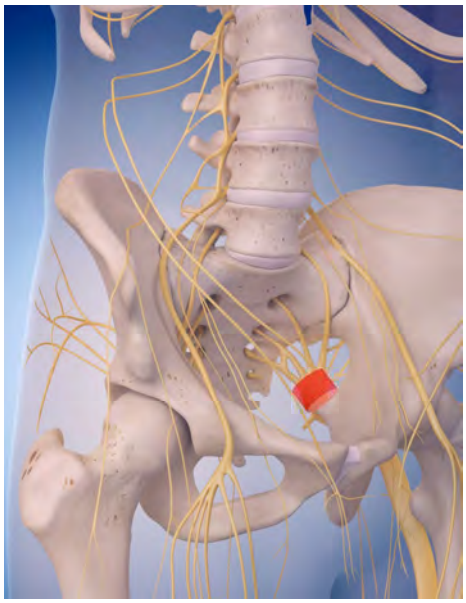
Local effects of peripheral nerve entrapment



Nerve compression as low as 20-30mmHg may create ischaemia

Prolonged or repetitive compression may lead to local demyelination

Abnormal Impulse Generating Sites (AIGS)

Debri & activation of immune cells

Local inflammatory response & oedema

Neural fibrosis (intra & extra neural) & impaired biomechanics

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Ischaemia & Night Pain

Ischaemia explains night pain & position dependent symptoms where fluid flow is compromised

Pain is often worse at night but will be relieved by gentle movement

Due to physiological drop in nocturnal BP & related drop in pressure gradient that pushes axonal fluid flow

If fluid flow is then compromised, there will be subsequent changes in metabolic activity and ectopic firing

This may explain night cramps that are experienced by those with nerve entrapments

Movement will usually reduce these symptoms as fluid flow is improved

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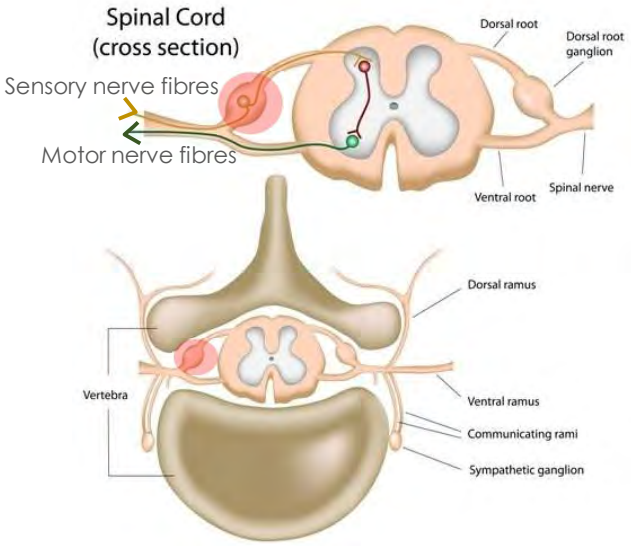
Remote effects of peripheral nerve entrapment



- Dorsal root ganglion (DRG) contains cell bodies of afferent nerve fibres
- Nerve fibres from multiple spinal levels pass through each dorsal root ganglion
- Evidence has shown immune-mediated inflammation at DRG, 2° to peripheral nerve entrapment
- More severe nerve injuries can also create a neuroinflammatory response in the spinal cord (esp dorsal horn) & higher pain centres
- Effects may spread to the contralateral dorsal horn & DRG

Schmid et al 2013, 2018

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Remote effects of peripheral nerve entrapment

Explain extraterritorial spread of symptoms

Explain mirror pain

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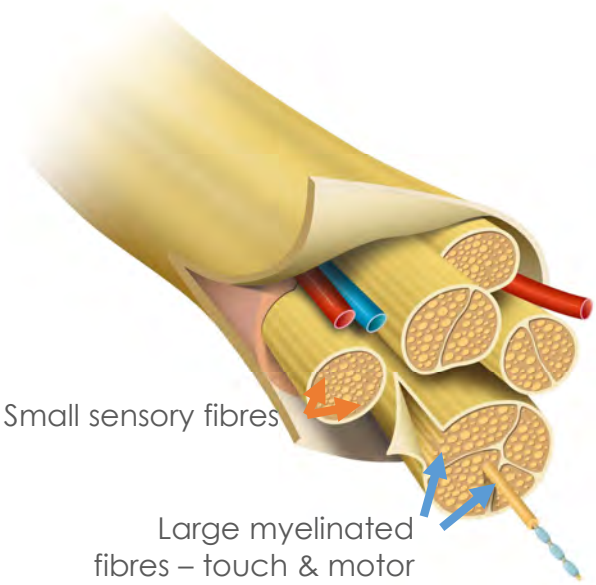
Assessing nerve health



Initial/primary effect on thin sensory & nociceptive fibres – make up 80% of the nerve

Large fibres – undergo demyelination but axons remain intact with most entrapment neuropathy

Initial symptoms – pain and sensory disturbance. Motor disturbance only with more severe nerve injury

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Assessing nerve health

Large Fibre Nerve Tests
Light touch
Vibrometry
Texture discrimination
Two point discrimination
Reflexes
Muscle testing
Electrodiagnostic testing

-ve light touch, motor or nerve condition tests **DO NOT** rule out entrapment neuropathy

Schmid 2016, Schmid et al 2018

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Assessing nerve health

Large Fibre Nerve Tests	Small Fibre Nerve Tests
Light touch	Pin-prick sensitivity
Vibrometry	Warm/Cold testing
Texture discrimination	Quantitative Sensory testing
Two point discrimination	Sympathetic Reflex Testing
Reflexes	Laser or heat evoked potentials
Muscle testing	Skin biopsy
Electrodiagnostic testing	

Schmid 2016, Schmid et al 2018

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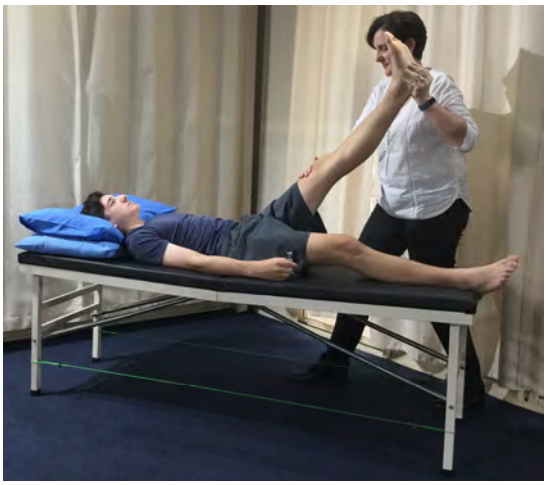
Neurodynamic Testing

Negative neurodynamic tests do NOT exclude the presence of nerve dysfunction

→ patients with more severe nerve damage are less likely to test +ve on NDT

Exaggerated responses to NDT may be due to generalised sensitisation, rather than sensitisation of peripheral nerves

NDT are not diagnostic for neuropathy but detect heightened neural mechanosensitivity



Baselgia et al 2016, Boyd et al 2010, Schmid et al 2018

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Improving nerve health and reducing pain

Centrally directed treatment is required, particularly for those demonstrating signs of generalised sensitisation

- Explain Pain, Reduce Fear, Reduce general stress/anxiety, Increase Self efficacy, Sleep Health, General Health, Exercise, Socialisation

***Importance of addressing local triggers – optimise health of local nerve & its interface with other tissues**

- Exercise or REST from exercise of adjacent muscles, optimise muscle health, resting tone, length, ND Rx
- Load management & exercise key principles

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Effects of neurodynamic treatments

Biomechanical effects??

No evidence of increases in nerve excursion

However ND treatment has been shown to:

Produce short lasting hypoalgesia

Aid dispersal of intraneural oedema

Stimulate anti-inflammatory effects within DRG & higher pain centres

Activate endogenous opioid analgesic pathways

Facilitate peripheral nerve regeneration

Schmid et al 2018

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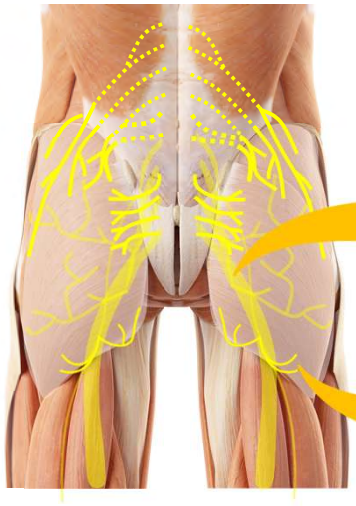
Local nerve related pain



Irritation or entrapment of peripheral nerves that transit or serve the lateral hip or buttock region

Deep Gluteal Syndrome

Non-sciatic Neuralgia

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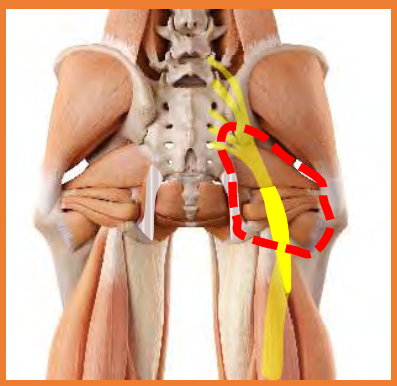
LATERAL HIP & BUTTOCK PAIN
Nerve Related Pain
Deep Gluteal Syndrome- Part 1

Module 3 – Lesson 2

Nerve Related Pain
Deep Gluteal Syndrome



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Buttock Pain & Sciatic Neuralgia

WHAT? → **Terminology**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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Terminology

Sciatic Nerve Entrapment/Impingement
– Extraspinal, Non-discogenic, Extrapelvic

Deep Gluteal Syndrome:
Buttock Pain & Dysaesthesia associated with sciatic nerve compression within the deep gluteal space

Encompasses

- '*Piriformis Syndrome*', one source of potential compression within the deep gluteal space
- Gemelli-Obturator Internus Syndrome
- Ischial Tunnel Syndrome

Hernando et al 2015, Martin et al 2015, Byrd 2015

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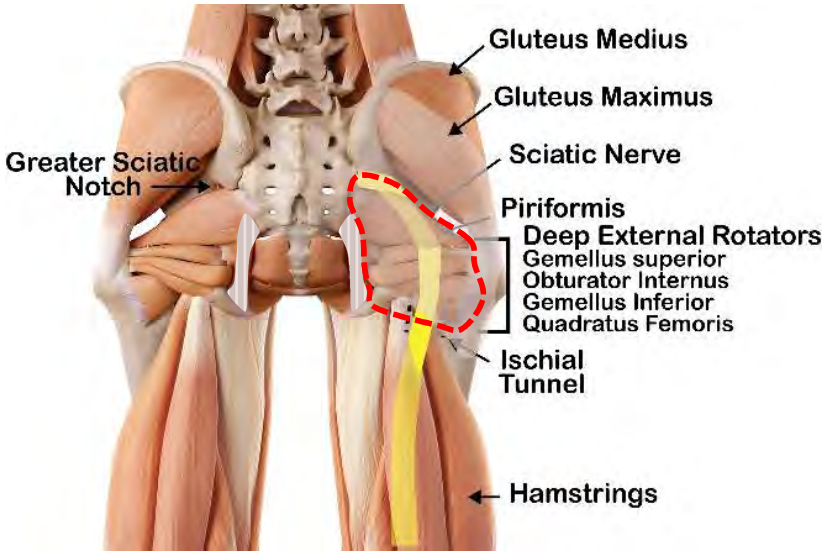
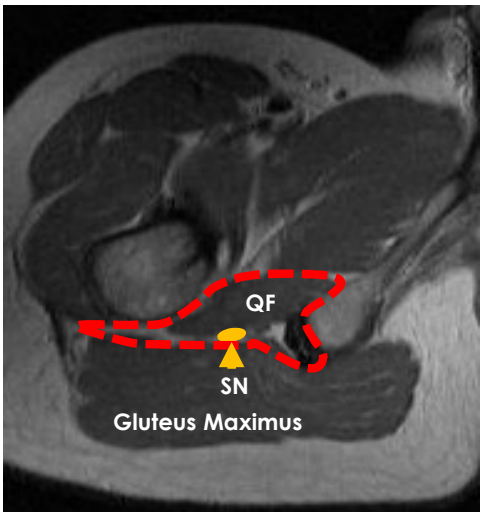
The Deep Gluteal Space



Axial MRI: Level of ITuberosity



Martin et al 2015

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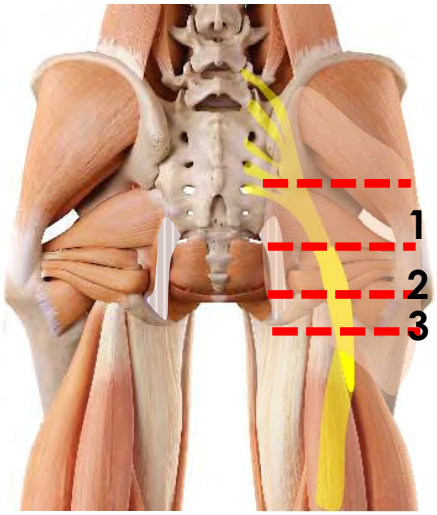
Deep Gluteal Syndrome: Potential sites & structures

Zone 1: Greater sciatic foramen/piriformis
Piriformis muscle (Piriformis syndrome)
Zone 2: Posterior Hip
Gemelli – Obturator Internus Complex
Zone 3:Ischial Tunnel
Hamstring Tendons of origin
Ischial tuberosity & Femur
Global:
Fibrous bands, Vascular Abnormalities
Space occupying lesions
– tumours, cysts – paralabral



Martin et al 2015, Hernando et al 2015

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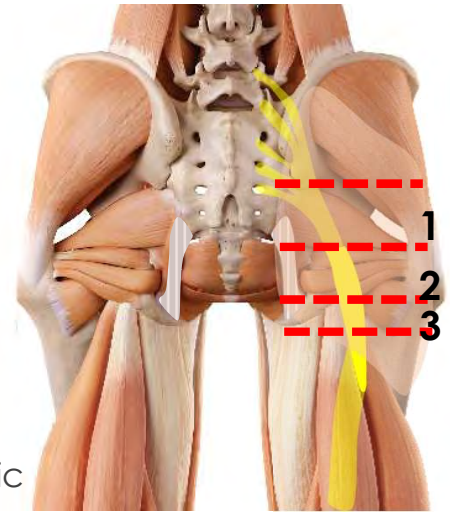
Deep Gluteal Syndrome: Mechanisms

Zone 1: Greater sciatic foramen/piriformis
Piriformis muscle – anatomic variation, hypertrophy, dynamic impingement
Zone 2: Posterior Hip
Relationship with Gemelli – OI Complex
Zone 3:Ischial Tunnel
Proximal Hamstring Tendinopathy, Avulsion
Ischiofemoral Impingement, QF pathology
Greater Trochanter – Ischial Impingement

Global:
Anatomic variation
Fibrous bands associated with trauma or inflammatory or infective process, iatrogenic
Carcinoma, lipoma, cysts – paralabral



Hernando et al 2015, Martin et al 2015, Martin & Gómez-Hoyos 2019

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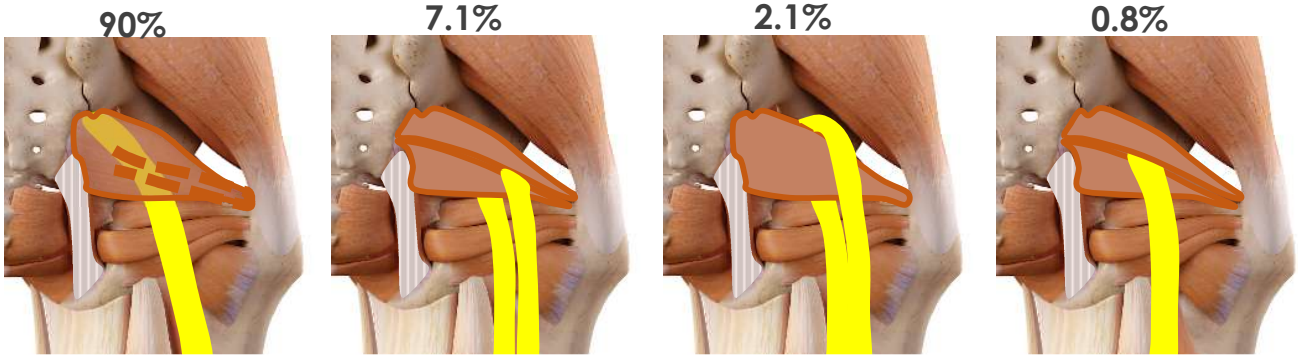
Deep Gluteal Syndrome: Mechanisms

Zone 1: Greater sciatic foramen/piriformis
Piriformis muscle – varying piri-SN anatomic relationship, varying anatomy of piri muscle or tendon



Beaton & Hanson 1937, Hernando et al 2015, Martin & Gómez-Hoyos 2019, Smoll 2010

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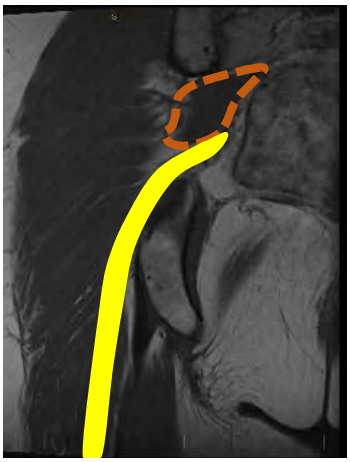
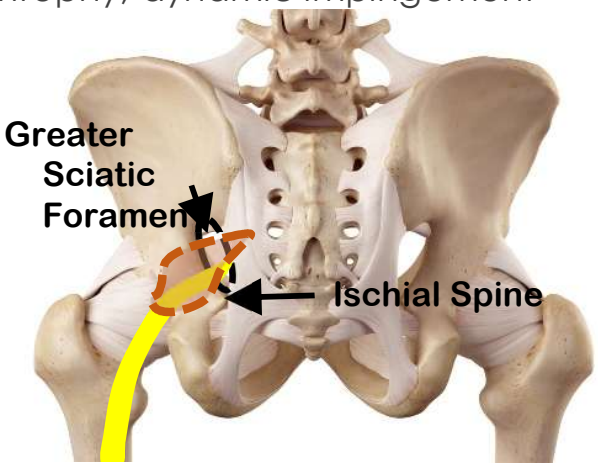
Deep Gluteal Syndrome: Mechanisms

Zone 1: Greater sciatic foramen/piriformis

Piriformis muscle – hypertrophy, dynamic impingement





Martin et al 2015, Hernando et al 2015

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Deep Gluteal Syndrome: Mechanisms

Fibrous, fibrovascular & vascular bands

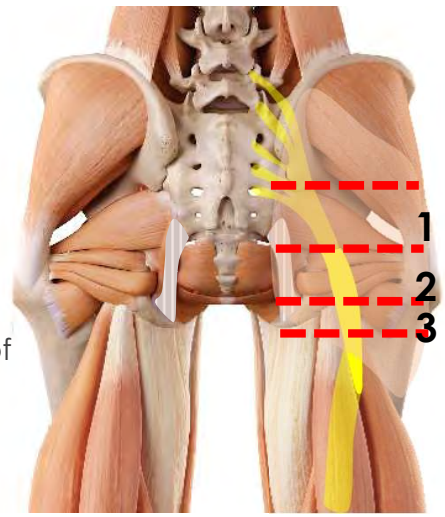
We all have fibrous bands in our DGS

Possible role in maintaining SN pathway

Strong constrictive bands can be problematic

- prevent normal nerve mobility
- may result in ischaemia & other changes common to peripheral nerve entrapment

Fibrous bands – like fibrous bands of scar tissues of various shapes and sizes and in various locations



Hernando et al 2015, Martin et al 2015, Martin & Gómez-Hoyos 2019

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Deep Gluteal Syndrome: Mechanisms

Fibrous, fibrovascular & vascular bands

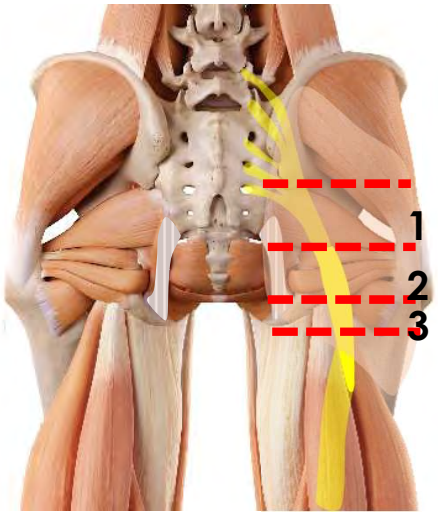
May develop secondary to:

Trauma
Inflammation or Infection
Iatrogenic causes e.g. surgery, injection
Vascular anomalies

Location described as:

Proximal: Zone 1
Middle: Zone 2
Distal: Zone 3

Medial or Lateral to the sciatic nerve



Hernando et al 2015, Martin et al 2015, Martin & Gómez-Hoyos 2019

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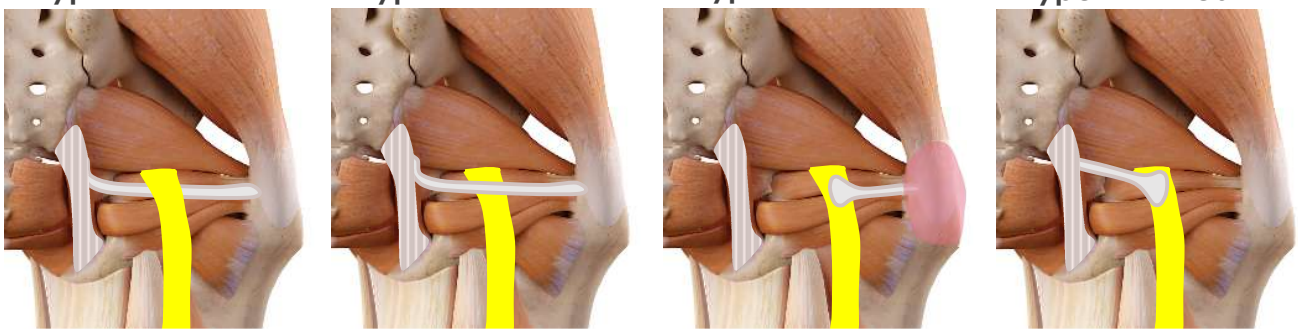
Deep Gluteal Syndrome: Mechanisms

Fibrous, fibrovascular & vascular bands

Type 1: Compressive or bridge type bands

Type 2: Adhesive or horsestrap bands

Type 1A - Ant | **Type 1B - Post** | **Type 2A - Lat** | **Type 2B - Med**



Type 3 – Anchored to SN with undefined distribution

Hernando et al 2015, Martin & Gómez-Hoyos 2019

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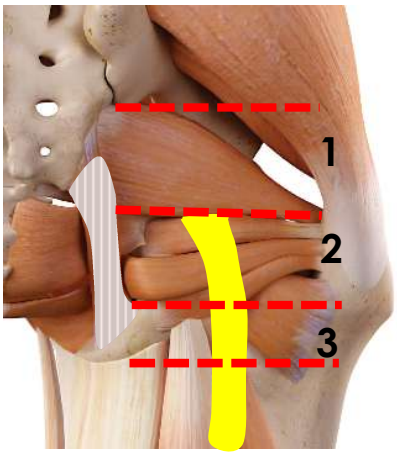
Deep Gluteal Syndrome: Mechanisms

Zone 2: Posterior Hip

Gemelli – Obturator Internus Complex

G-OI Related Sciatica has been related to:

- anatomical variation - SN running through OI
- hypertrophy, overuse, increased resting tone (Consider pelvic floor health & internal Ax)
- Scissor effect between piri & OI-G
- Fibrous connection OI-G & SN



Balius et al 2018, Meknas et al 2009, Hernando et al 2015, Martin & Gómez-Hoyos 2019

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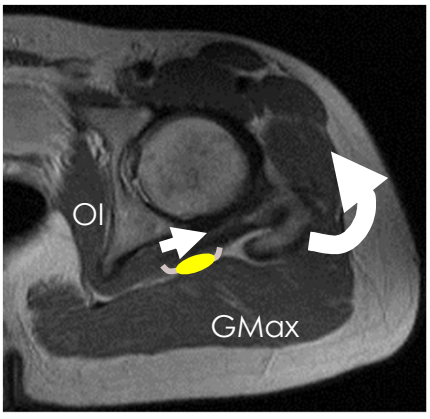
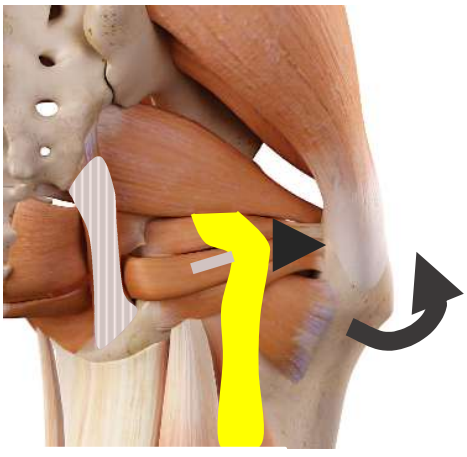
Deep Gluteal Syndrome: Mechanisms

Zone 2: Posterior Hip

Gemelli – Obturator Internus Complex





Balius et al 2018

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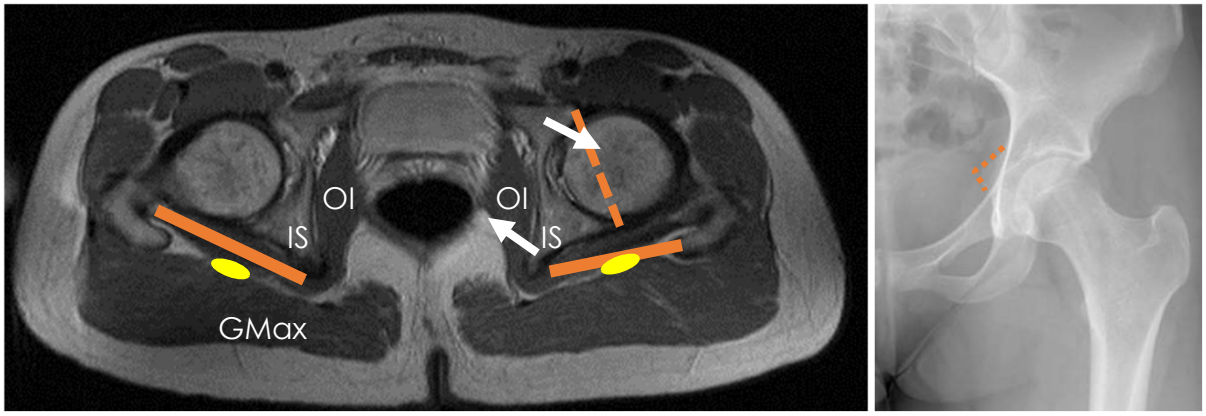
Deep Gluteal Syndrome: Mechanisms

Zone 2: Posterior Hip – G-OI Complex: Acetabular Morphology



Acetabular retroversion may in some individuals contribute to DGS

GMax: Gluteus maximus; OI: Obturator Internus; IS: Ischial Spine

Filler 2008, Kalbera et al 2008

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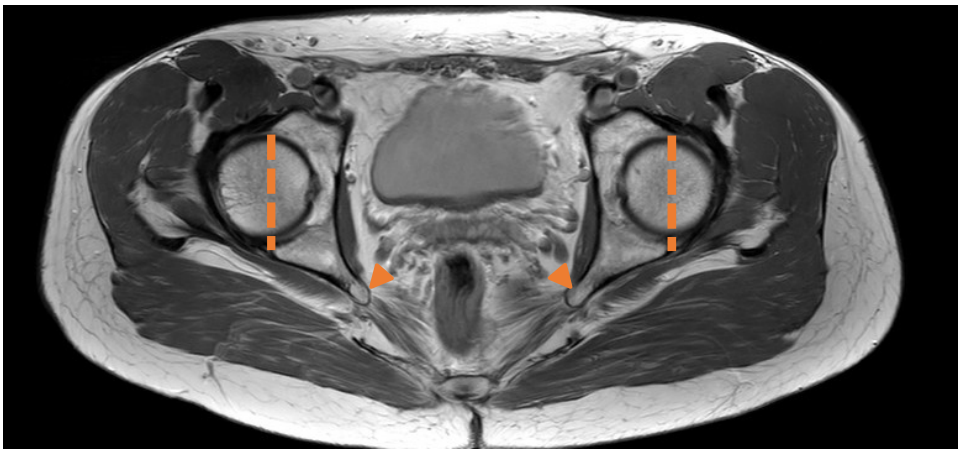
Deep Gluteal Syndrome: Mechanisms

Zone 2: Posterior Hip – G-OI Complex: Acetabular Morphology



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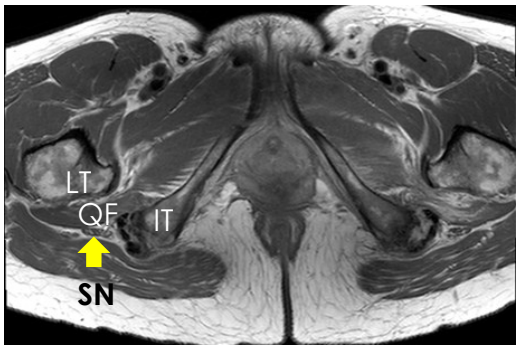
Deep Gluteal Syndrome: Mechanisms

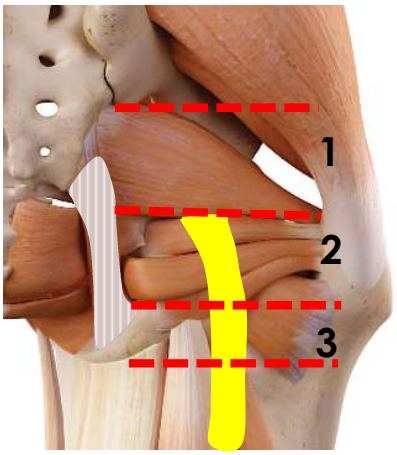
Zone 3:Ischial Tunnel

Proximal Hamstring Tendinopathy, Avulsion
Ischiofemoral Impingement, QF pathology
Greater Trochanter – Ischial Impingement



IFI: In
Hip Ext, Adduction, ER

GT-II: In
Hip Flexion, Abduction, ER (FABER)



Hernando et al 2015, Kivlan et al 2016, Martin & Gómez-Hoyos 2019

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Buttock Pain & Sciatic Neuralgia

WHAT? → **Terminology**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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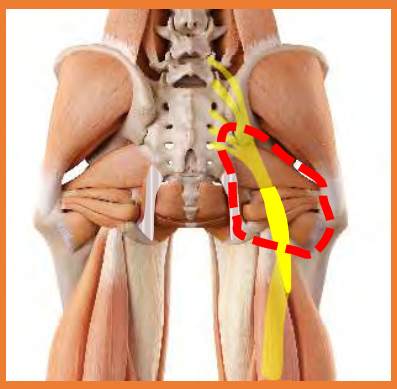
LATERAL HIP & BUTTOCK PAIN
Nerve Related Pain
Deep Gluteal Syndrome - Part 2

Module 3 – Lesson 3

Nerve Related Pain
Deep Gluteal Syndrome



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Buttock Pain & Sciatic Neuralgia

WHAT? → **Terminology**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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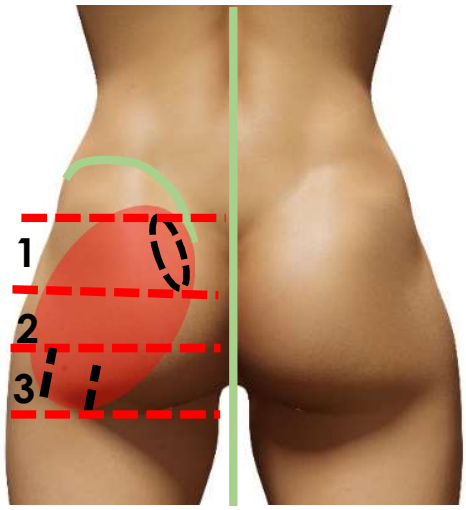
Clinical Indicators of Deep Gluteal Syndrome

Interview Features:

Buttock pain in deep gluteal space
+/- other lower limb pain – sciatica
+/- lower back pain
+/- paraesthesia

Pain on sitting
Pain in slump type postures or activities where SN is on stretch or moving between structures in buttock

Note any Hx trauma/surgery
*Note Hx of gynae surgery or issues – rule out intra-pelvic SN entrapment



Hernando et al 2015, Martin et al 2015, Martin & Gómez-Hoyos 2019

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Buttock Pain & Sciatic Neuralgia

WHAT? → **Terminology**
WHY? → **Mechanisms**
HOW? → **Clinical Indicators**
→ **Management**

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Clinical Indicators of Deep Gluteal Syndrome

Physical Features:

Contraction | Stretch of adjacent muscles – Piriformis & G-OI Complex

Active Piri Test (Beatty Test)

Seated Piri Stretch Test

FAIR Test

HCLK Test (Heel Contra-Lateral Knee)

Prone IR (Freiberg test)

SN:91%; SP:80%; +LR:4.57;-LR:0.11:DOR:42

Can also add contraction to passive stretch

Hopayian & Danielyan 2018, Martin et al 2015, Michel et al 2013

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Clinical Indicators of Deep Gluteal Syndrome

Physical Features:

Test for PHTears +/- Ischial Tunnel SN Entrapment

Active Hamstring Test- Resisted knee F
@30° vs @90° F

Tests for IFI & GT-II

Gómez-Hoyos et al 2016, Martin et al 2018

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Other Investigations

Imaging

MRI & MR Neurography
Ultrasound – Piriformis size & stiffness, dynamic Ax

Electrodiagnosis

EMG: Delay in H-Reflex in FAIR/stretch position
Nerve Conduction Studies

Injections

Guided injection LA/CSI into region of suspected entrapment

Fishman et al 2002, Fishman & Hosseini 2019, Koca et al 2018, Martin et al 2018, Zhang et al 2019

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Management of Deep Gluteal Syndrome

Medical Mx:

- Pharmacology – Oral & Injection - CSI/LA, Botox Piriformis
  - Botox Outcomes: 'Very good/Good':77%; 'Average':7.4%; 'Poor':15.6%
- Surgery – decompression, piriformis release, OI release
  - Decision to operate in 50% cases made based on clinical findings & diagnostic investigations alone, other 50% require failure of non-operative Rx
  - Overall outcome studies are poor quality, high risk of bias or low subject numbers.
  - All report good outcomes with low complication rates
  - However others warn of skill required & risk of iatrogenic injury

Kay et al 2017, Martin et al 2015, Michel et al 2013, Meknas et al 2013, Nakano et al 2017

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Management of Deep Gluteal Syndrome

Non-Medical Mx:

- Load management/Education – Physical & Psychological
- Exercise therapy
  - Optimise health and compliance of tissues adjacent to the sciatic nerve - piriformis, deep ext rotators, hams
  - Neurodynamic exercises – sliders
  - Address other associated impairments
- Manual therapy as adjunct - avoid aggressive pressure in greater sciatic foramen, along line sciatic nerve

Schröder et al 2016

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SCIATIC NERVE IMPINGEMENT
Load Mx in ADL





Chair forward
Sit higher
Recline a little

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SCIATIC NERVE IMPINGEMENT
Load Mx in Sport, Recreation

Avoid/reduce hills

Avoid/reduce stairs

Avoid/minimise sustained forward leaning

Watch hip vs knee flexion R/T to upright frequently
Check stick length

Reduce time spent on drops

Avoid/minimise hills, heavy gears

Optimise saddle height, crank length



Similar load management to proximal hamstring tendinopathy

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Exercise therapy for Sciatic Nerve Impingement

Downtrain/lengthen buttock musculature as required/tolerated

*avoid sustained stretch

Local mobilisation nerve – soft tissue interface

Global Sciatic Nerve Gliding - Flossing

'Kick your head off' … slowly & gently

Address individual impairments – closely monitor response

May require Women's/Men's Health Ax/Mx

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Evidence for Non-operative management

Michel et al 2013:

'Cure rate' of 51.2% of 250 combined medication & rehabilitation

Physiotherapy 3x/week – massage & home ex – stretching/mobility ex's

Schröder et al 2016: Case series of 6 patients

- Guided injection of local anaesthetic & steroid
- Neuropsychiatric counselling
- Home exercise program – Piri stretches (max 20s), nerve gliding, muscles strengthening, movement/proprioceptive retraining, pelvic floor therapy
- Manual therapy

All gained benefit from Rx, average time in treatment 20 weeks (6-36)

- VAS 7.16 – 1.6, mHHS 60.01 - 74

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Looking to the future >>>

Growing awareness & understanding of the condition & mechanisms

Some evidence for diagnostic tests

Further high quality diagnostic accuracy studies required

Evidence on both surgical & non-surgical management still largely low quality

Further studies required to clarify which rehabilitative approaches are likely to produce best & most expedient outcomes

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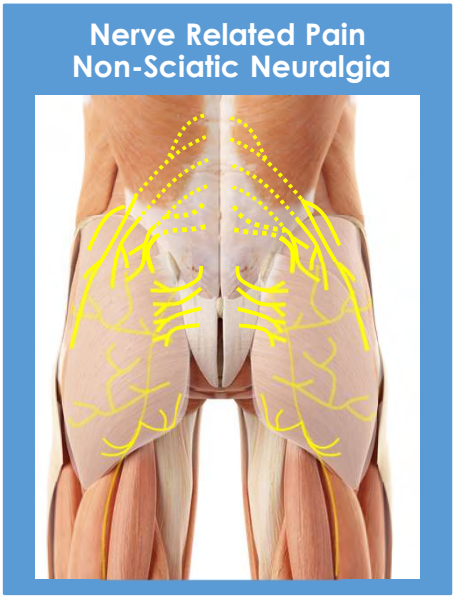
LATERAL HIP & BUTTOCK PAIN
Nerve Related Pain
Non-Sciatic Neuralgia - Part 1

Module 3 – Lesson 4



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Nerve Related Pain: Non-sciatic Neuralgia

WHAT? → **Sources of Nociception**

WHY? → **Mechanisms**

HOW? → **Clinical Indicators**

→ **Management**

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Non-sciatic neuralgia of the lateral hip & buttock

PART 1

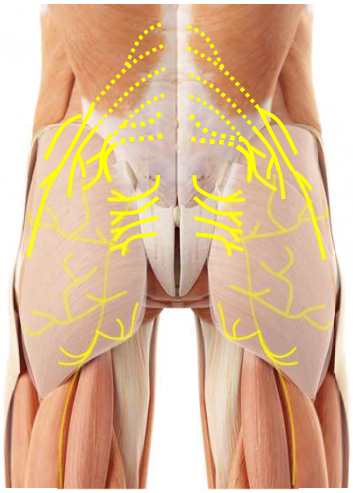
Neuralgia in the lateral hip region
- Iliohypogastric nerve
- Subcostal nerve

Nerves serving the skin of the buttock
- Superior cluneal nerves
- Middle cluneal nerves

PART 2

- Posterior femoral cutaneous nerve & the Inferior cluneal nerves

Gluteal nerves (motor nerves)
- Superior gluteal nerve
- Inferior gluteal nerve



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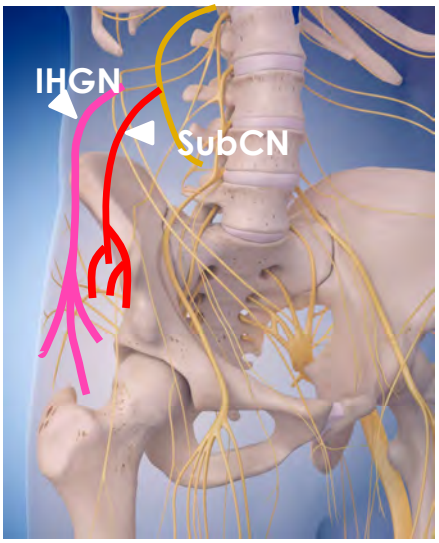
Neuralgia in the Lateral Hip Region



IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve

Nielsen et al 2018, Maigne et al 1986, McRory & Bell 1999

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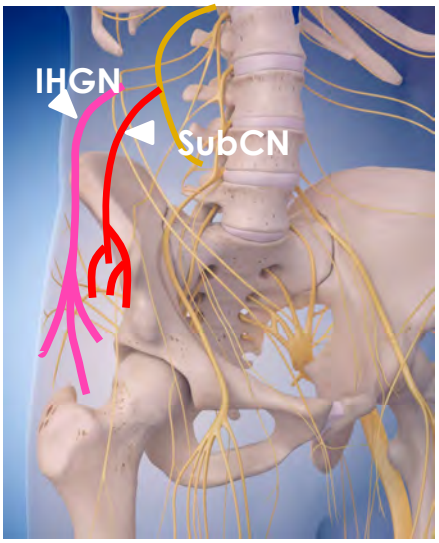
Iliohypogastric & Subcostal Nerves



Nerves	Origin
Subcostal Nerve	Ventral ramus of T12
Iliohypogastric Nerve	Ventral ramus of L1

Lateral cutaneous branches cross the iliac crest to serve the skin of the lateral hip

Anterior branch IHGN:

- suprapubic skin
- internal oblique & transversus abdominis

IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve

Nielsen et al 2018, Maigne et al 1986, McRory & Bell 1999

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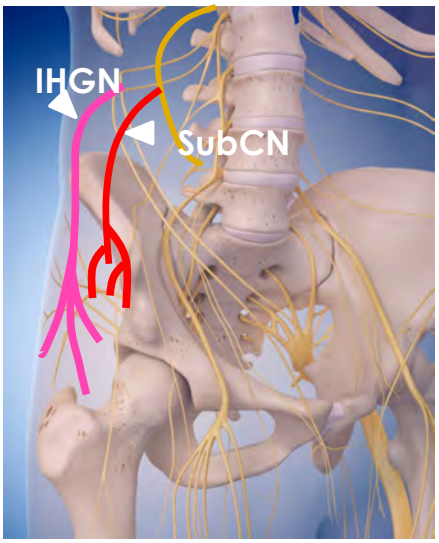
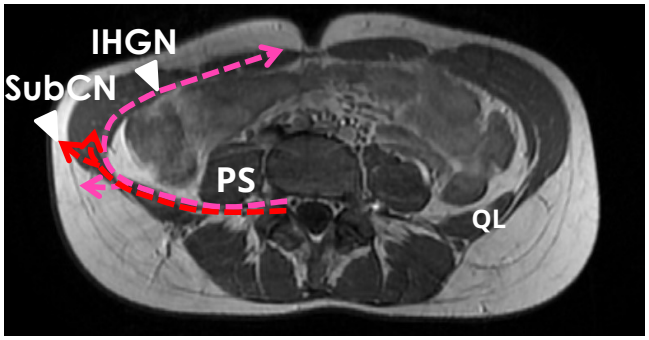
Iliohypogastric & Subcostal Nerves

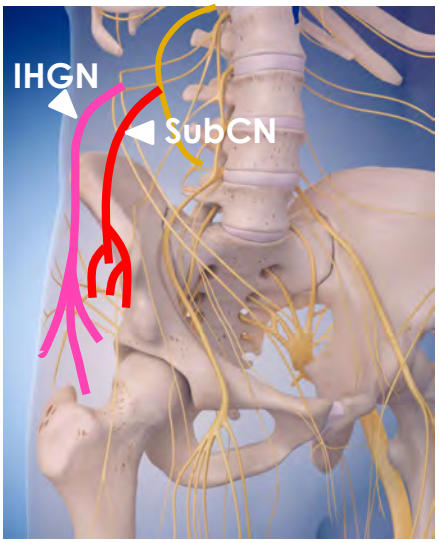




IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve; PS: Psoas muscle; QL: Quadratus Lumborum

Nielsen et al 2018, Maigne et al 1986, McRory & Bell 1999

Iliohypogastric & Subcostal Nerves



Point at which IC crossed, posterior to ASIS:

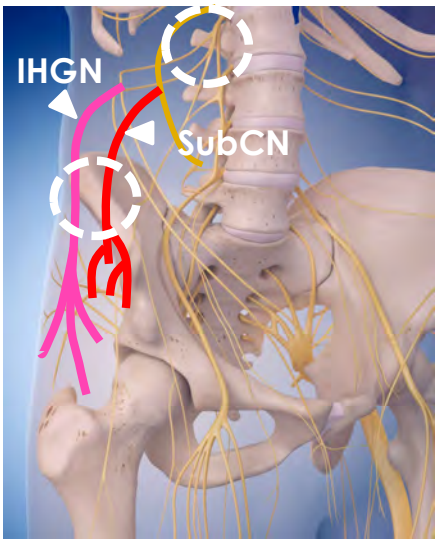
SubCN: 2 - 7cm

IHGN: 7 - 11cm, through an osseo-fibrous tunnel

IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve; IC: Iliac Crest; ASIS: Anterior Superior Iliac Spine

Maigne et al 1986

Iliohypogastric & Subcostal Neuralgia



Mechanisms:

- Tight clothing
- Trauma – direct impact
- Physical loading: traction/shearing/compression
  - Within abdominal wall
  - Within paraspinals
- Iatrogenic
  - bone graft, spinal sx, abdo sx
- Inflammatory neuraglia, tumours

IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve

Maigne et al 1986, McRory & Bell 1999

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Clinical Indicators of Neuralgia of the Lateral Hip

Interview Features:

- Lateral hip pain

+/- paraesthesia lateral hip

- Physical activity- abdo loading, impact
- Note any surgical Hx: bone graft/Lx/abdo

Physical Features:

- *Palpation: point tenderness on iliac crest

- May exhibit hyperalgesia

IHGN: Iliohypogastic Nerve; SubCN: Subcostal Nerve; ASIS: Anterior Superior Iliac Spine

Maigne et al 1986, McRory & Bell 1999

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Clinical Indicators of Neuralgia of the Lateral Hip

Physical Features:

Try stretching/loading adj soft tissues

(Pain relieved by local nerve block)

Maigne et al 1986, McRory & Bell 1999

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Management of Neuralgia of the Lateral Hip

Medical Mx: Maigne et al 1986, McRory & Bell 1999

Pharmacological – oral, L/A block, CSI
RFN
Surgery – decompression

Non-Medical Mx: ***(No evidence)***

Load Mx: Clothing & physical activity advice
Kinematics/technique – Strategies to reduce excessive pelvic tilt/trunk LF
Neurodynamic exercises – sliders
Reduce tension in adjacent soft tissues but stretching unhelpful?
Optimise health of adjacent soft tissues – abdo function, respiration
Lx manual therapy (mechanical/neurophysiological effect?)- PPIVMs

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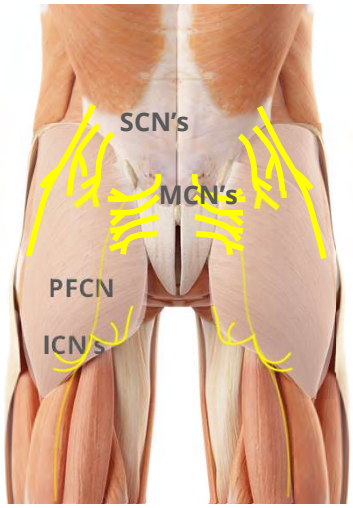
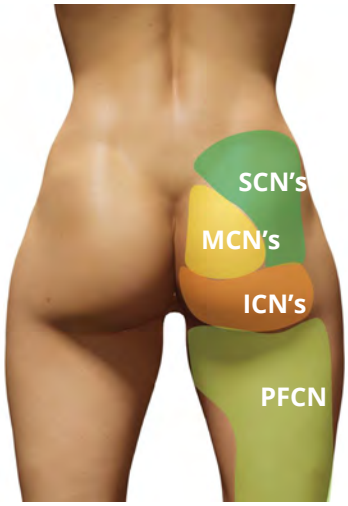
Cluneal Nerves





SCN's: Superior Cluneal Nerves; MCN's: Middle Cluneal Nerves;
ICN's:Inferior Cluneal Nerves; PFCN: Posterior Femoral Cutaneous Nerve.

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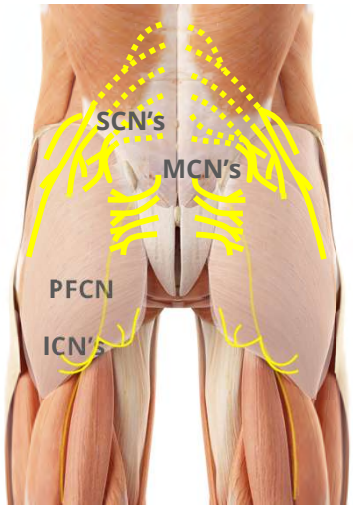
Cluneal Nerves



Nerves	Origin
Superior Cluneal Nerves	L1- 3 May be as broad as T11-L5
Middle Cluneal Nerves	Posterior sacral foramina S1–4
Inferior Cluneal Nerves	Branch off PFCN, which arises from sacral plexus *S2

SCN's: Superior Cluneal Nerves; MCN's: Middle Cluneal Nerves;
ICN's: Inferior Cluneal Nerves; PFCN: Posterior Femoral Cutaneous Nerve.

Iwanaga et al 2018, Konno et al 2017, Lu et al 1998, Tubbs et al 2010

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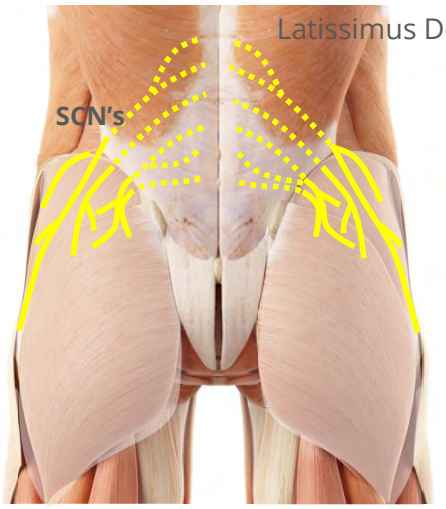
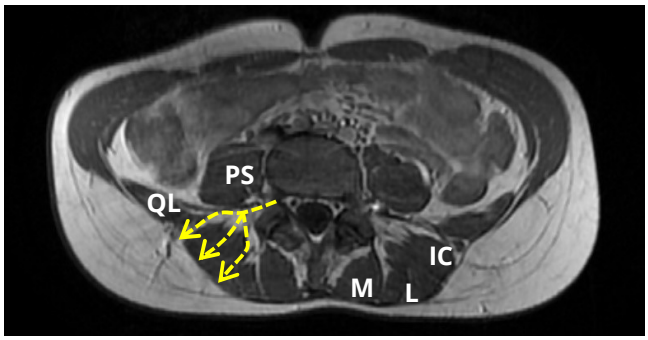
Superior Cluneal Nerves





SCN's: Superior Cluneal Nerves; QL: Quadratus Lumborum muscle; PS: Psoas muscle; M: Multifidus muscle;
L: Longissimus muscle; IC: Iliocostalis muscle.

Iwanaga et al 2018

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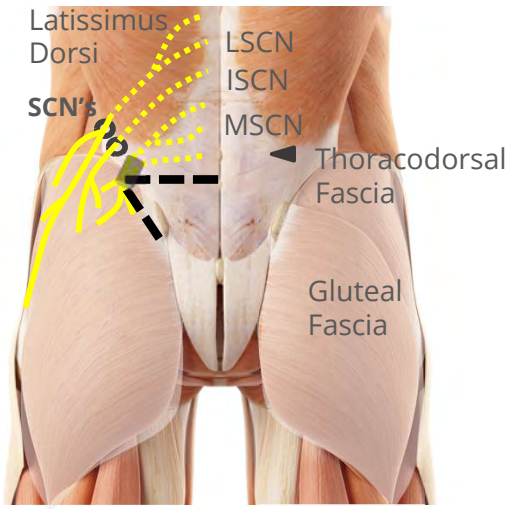
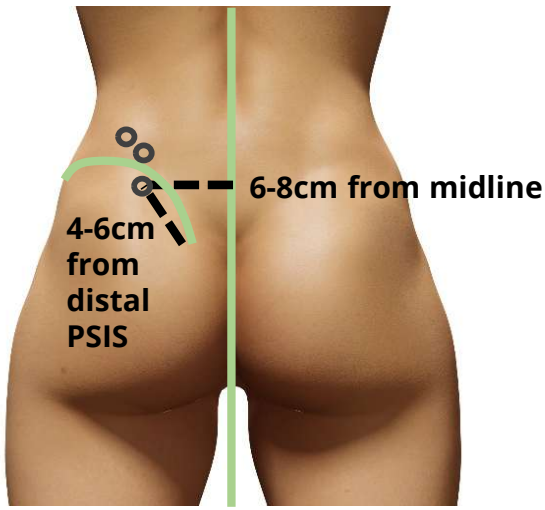
Superior Cluneal Nerves





LSCN: Lateral Superior Cluneal Nerve; ISCN: Intermediate Superior Cluneal Nerve;
MSCN: Medial Superior Cluneal Nerve; PSIS: Posterior Superior Iliac Spine

Iwanaga et al 2018, Isu et al 2018, Konno et al 2017, Lu et al 1998, Tubbs et al 2010

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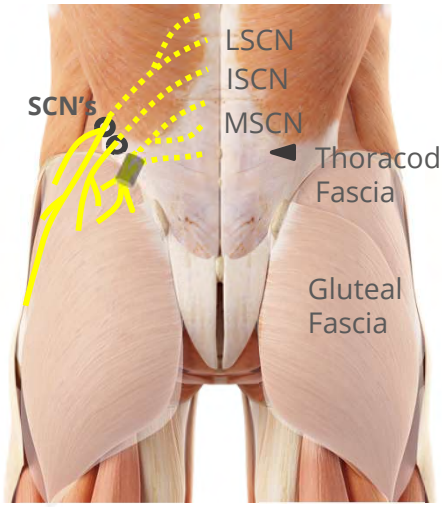
Superior Cluneal Neuralgia



Mechanisms:

- Trauma – direct impact
- Iatrogenic – bone graft, spinal surgery
- Physical loading: traction/shearing/compression
  a. Paraspinal muscles – PS, QL, ES
  b. Lat Dorsi & thoracodorsal fascia
  c. Gluteus maximus & gluteal fascia
- Inflammatory neuraglia

LSCN: Lateral Superior Cluneal Nerve; ISCN: Intermediate Superior Cluneal Nerve; MSCN: Medial Superior Cluneal Nerve; PSIS: Posterior Superior Iliac Spine

Chiba et al, 2016, Isu et al 2018, Kim et al 2018, Konno et al 2017, Lu et al 1998

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Clinical Indicators of Superior Cluneal Neuralgia

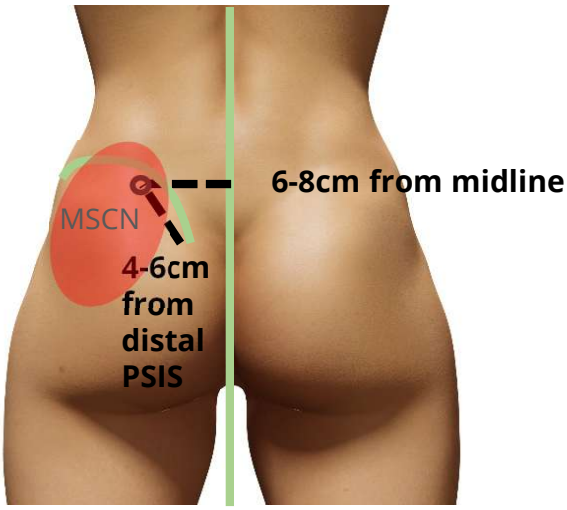
Interview Features:

- Upper buttock /L-Pelvic pain
+/- paraesthesia upper buttock
+/- other LL pain – 'pseudo-sciatica'
- Physical activity – Lx F, rotn, Ext
- Note any surgical Hx: bone graft/Lx

Physical Features:

- Pain on palpation of MSCN tunnel
- Reproduction of buttock P/paraes

(Pain relieved by local nerve block)



MSCN: Medial Superior Cluneal Nerve; PSIS: Posterior Superior Iliac Spine

Chiba et al, 2016, Isu et al 2018, Kim et al 2018, Konno et al 2017, Lu et al 1998

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Management of Superior Cluneal Neuralgia

Medical Mx: Chiba et al, 2016, Isu et al 2018, Kim et al 2018, Konno et al 2017, Morimoto et al 2013

- Local anaesthetic block +/- CSI
- RFN
- Surgery – decompression

Non-Medical Mx: ?

- Load Mx: High load & low load (ms activity at rest)
- Kinematics/technique – rowing/running
- Neurodynamic exercises – sliders
- Reduce tension in adjacent soft tissues but stretching unhelpful?
- Optimise health of adjacent soft tissues
- Lx manual therapy (mechanical/neurophysiological effect?)- PPIVMs

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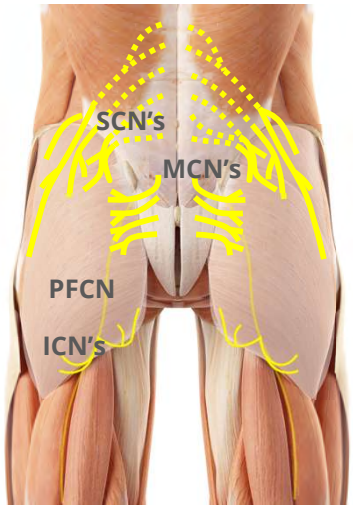
Cluneal Nerves



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SCN's: Superior Cluneal Nerves; MCN's: Middle Cluneal Nerves;
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Iwanaga et al 2018, Konno et al 2017, Lu et al 1998, Tubbs et al 2010

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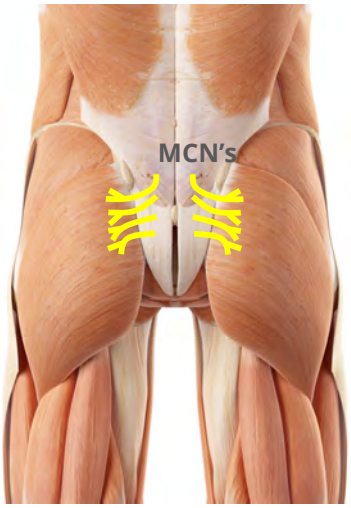
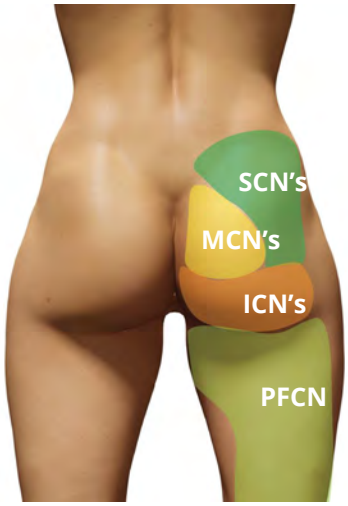
Middle Cluneal Nerves





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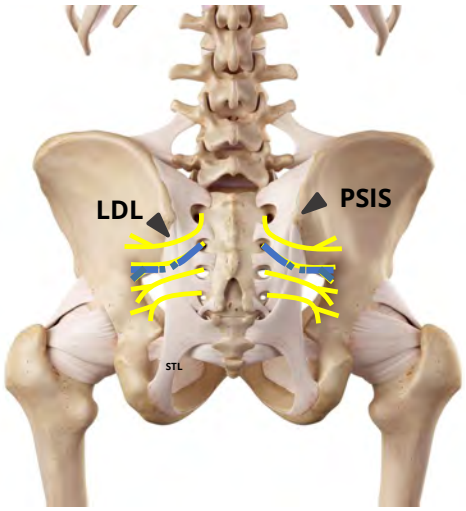
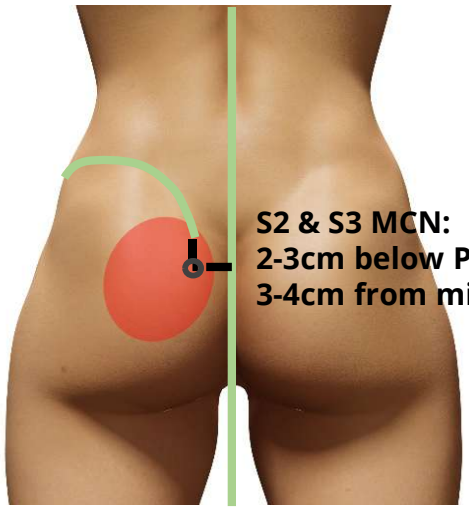
Middle Cluneal Nerves





LDL: Long dorsal ligament; STL: Sacrotuberous Ligament; PSIS: Posterior Superior Iliac Spine,
MCN: Middle Cluneal Nerve

Isu et al 2018, Konno et al 2017, McGrath & Zhang 2005, Tubbs et al 2010

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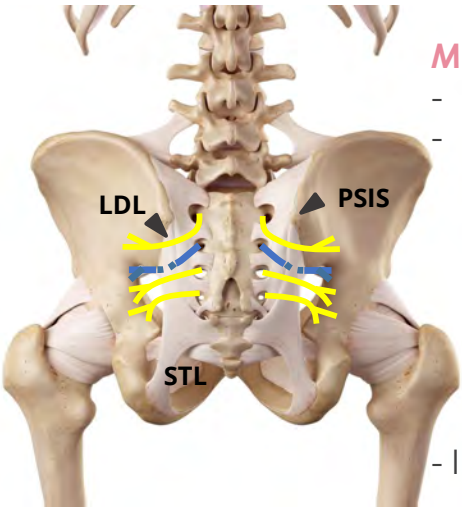
Middle Cluneal Neuralgia



Mechanisms:

- Trauma – direct impact – fall onto sacrum
- Physical loading:
  a. Tensioning of the LDL (& STL)
    - Counter-nutation – reduced Lx lordosis
    - Effect of hamstring contraction/stretch
    - Possibly effect of piriformis via STL
  b. Tensioning of TDF & Gluteal Fascia
    - Trunk extensors, lat dorsi, gluteals
- Inflammatory neuraglia, tumour

LDL: Long dorsal ligament; STL: Sacrotuberous Ligament;
PSIS: Posterior Superior Iliac Spine; TDF: Thoracodorsal Fascia.

Isu et al 2018, Konno et al 2017, Vleeming et al 2012

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Clinical Indicators of Middle Cluneal Neuralgia

Interview Features:

- Mid/medial buttock/L-pelvic pain

+/- paraesthesia in local region

+/- other LL pain – 'pseudo-sciatica'

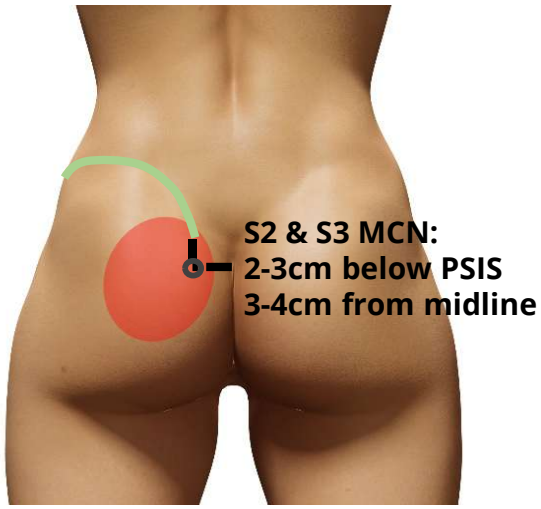
- Physical activity – walking, standing, bending/lifting, sitting, rolling

+/- associated with pregnancy

Physical Features:

- Pain on palpation of LDL
- Reproduction of buttock P/paraes

(Pain relieved by local nerve block)



MCN: Middle Cluneal Nerve; PSIS: Posterior Superior Iliac Spine

Isu et al 2018, Konno et al 2017

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Middle Cluneal Neuralgia & the SIJ

Many pain provocation tests for determining whether SIJ may be a source of pain, will also load the LDL & the Middle Cluneal Nerves

In some cases, tenderness of the LDL may indicate a local Middle Cluneal Nerve entrapment, rather than SIJ dysfunction

Management of Middle Cluneal Neuralgia

Medical Mx: Aota 2016, Isu et al 2018, Konno et al 2017

- Local anaesthetic block; CSI
- RFN
- Surgery – decompression

Non-Medical Mx: evidence?

- Load Mx: High load & low load (ms activity at rest)
- Kinematics/technique – load sharing – triple flexion not fwd lean
- Neurodynamic exercises – sliders
- Reduce tension in adjacent soft tissues but stretching unhelpful?
- Optimise health of adjacent soft tissues

Non-sciatic neuralgia of the lateral hip & buttock

PART 1

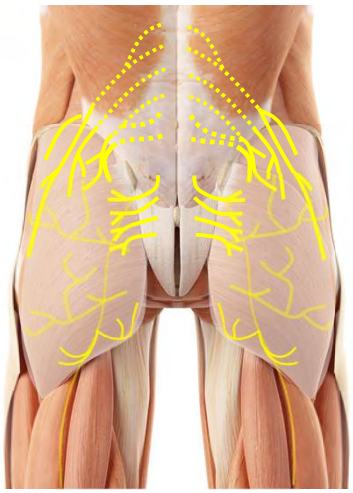
Neuralgia in the lateral hip region
- Iliohypogastric nerve
- Subcostal nerve

Nerves serving the skin of the buttock
- Superior cluneal nerves
- Middle cluneal nerves

PART 2

- Posterior femoral cutaneous nerve & the Inferior cluneal nerves

Gluteal nerves (motor nerves)
- Superior gluteal nerve
- Inferior gluteal nerve



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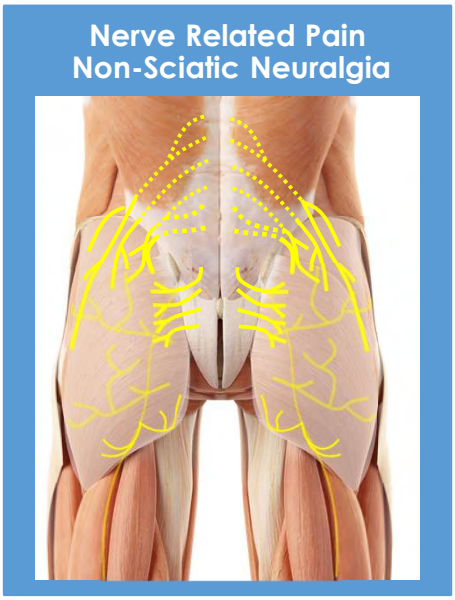
LATERAL HIP & BUTTOCK PAIN
Nerve Related Pain
Non-Sciatic Neuralgia - Part 2

Module 3 – Lesson 5



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Non-sciatic neuralgia of the lateral hip & buttock

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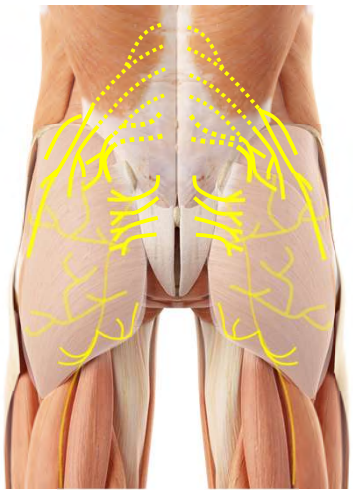

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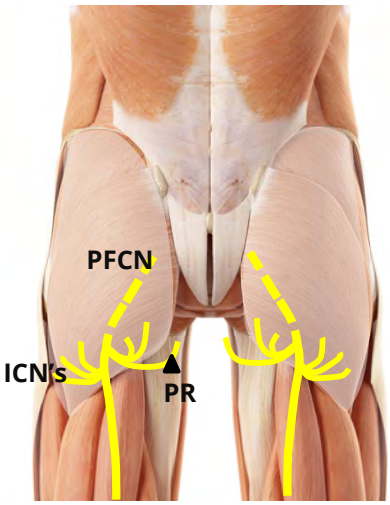
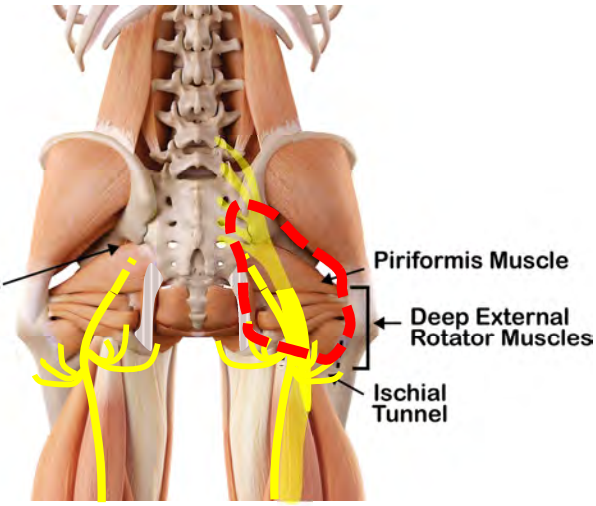
Posterior Femoral Cutaneous Nerve & Inferior Cluneal Nerves





PFCN: Posterior Femoral Cutaneous Nerve; ICN: Inferior Cluneal Nerves; PR: Perineal ramus

Darnis et al 2008, Ploteau et al 2017

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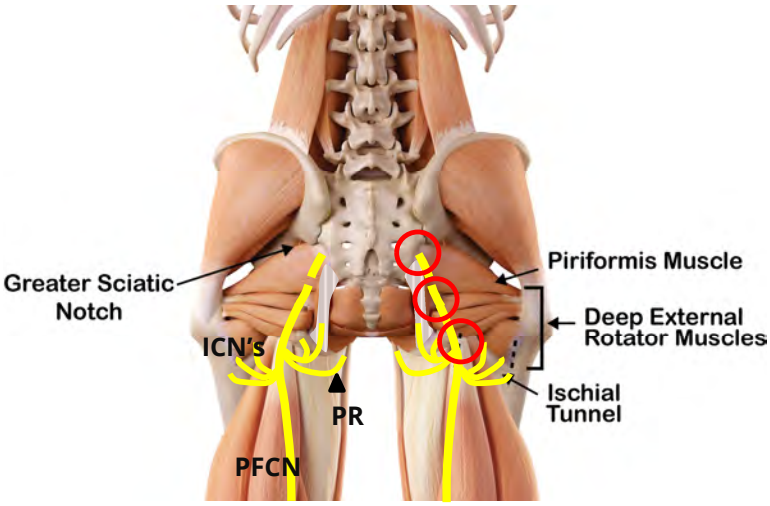
Neuralgia of the Posterior Femoral Cutaneous Nerve & the Inferior Cluneal Nerves

Areas of entrapment:

- Infra-piriform space
- Ischial region
  - Lateral fibrous expansion
- Deep gluteal space



PFCN: Posterior Femoral Cutaneous Nerve; ICN: Inferior Cluneal Nerves; PR: Perineal ramus

Darnis et al 2008, Ploteau et al 2017

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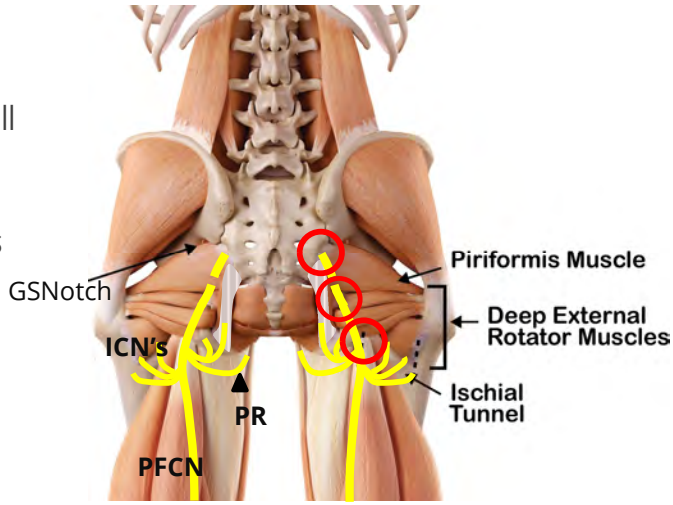
Neuralgia of the Posterior Femoral Cutaneous Nerve & the Inferior Cluneal Nerves

Mechanisms:

- Inflammatory neuraglia
- Trauma – direct impact – fall onto buttock or ischium
- PHT, avulsion
- DGS: muscles/fibrous bands
- Vascular Abnormalities
- Tumours, cysts



PR: Perineal ramus, ICN's: Inferior Cluneal Nerves; PFCN: Posterior Femoral Cutaneous Nerve; PHT: Proximal Hamstring Tendinopathy; DGS: Deep Gluteal Space

Darnis et al 2008, Ploteau et al 2017

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Clinical Indicators of Posterior Femoral Cutaneous Nerve & the Inferior Cluneal Nerves

Interview Features:

- Pain in infragluteal fold, genitofemoral fold, ischial region & posterior thigh
- PR: Lateral perineum/scrotum/labia majora

+/- paraesthesia in these regions

- Agg factors: sitting; other if M-T causes

Physical Features:

- Symptoms may sometimes be reproducible by palpation of ischium

Usually the diagnosis is based on symptoms, exclusion of other causes & confirmed by local nerve block

ICN: Middle Cluneal Nerve; PFCN: Posterior Femoral Cutaneous Nerve; PR: Perineal Ramus

Darnis et al 2008, Ploteau et al 2017

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Management of Posterior Femoral Cutaneous Nerve & the Inferior Cluneal Nerves

Medical Mx: Darnis et al 2008, Ploteau et al 2017

- L/A block; CSI
- RFN
- Surgery – decompression

Non-Medical Mx: ?

- Load Mx: Seating, Physical loading modification if relevant
- Neurodynamic exercises – sliders
- Reduce tension in adjacent soft tissues but stretching unhelpful?
- Optimise health of adjacent soft tissues

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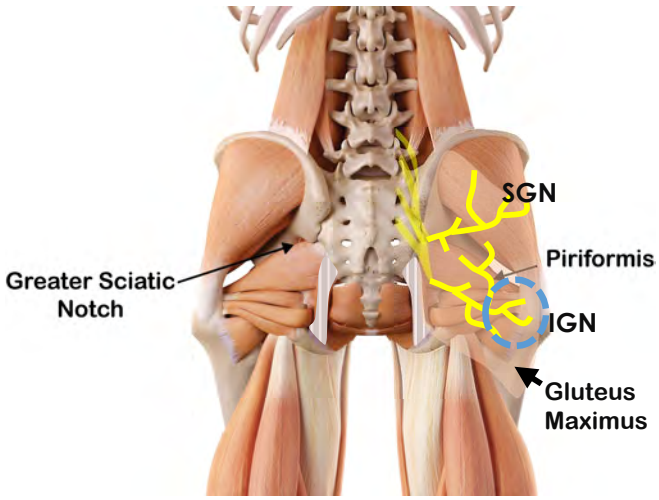
Superior & Inferior Gluteal Nerves



Nerve	Origin	Supply
Superior Gluteal Nerve	L4, L5, S1 Exits above piriformis	Gluteus medius Gluteus minimus TFL
Inferior Gluteal Nerve	L5, S1, S2 Exits below piriformis	Gluteus maximus Small area of skin in retrotrochanteric area.

SGN: Superior Gluteal Nerve; IGN: Inferior Gluteal Nerve

Florian-Rodriguez et al 2016, Iwanaga et al 2018a&b, McRory & Bell 1999

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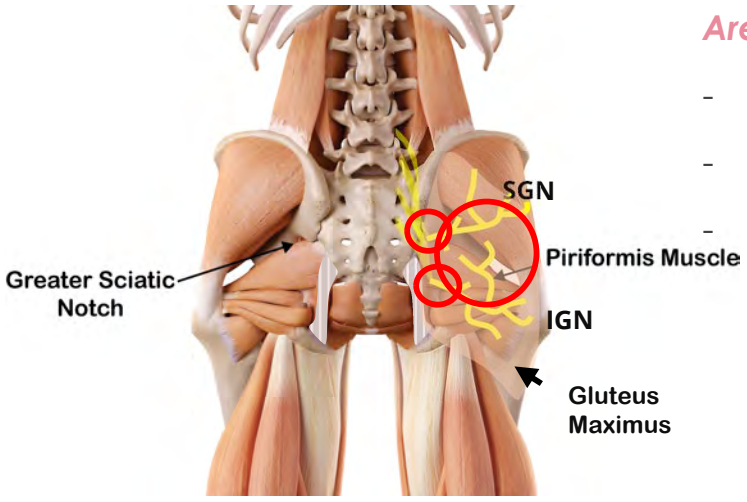
Superior & Inferior Gluteal Nerves



Areas of entrapment/injury:

- SGN: Supra-piriform space
- IGN: Infra-piriform space
- Deep gluteal space

SGN: Superior Gluteal Nerve; IGN: Inferior Gluteal Nerve

Florian-Rodriguez et al 2016, Iwanaga et al 2018, McRory & Bell 1999

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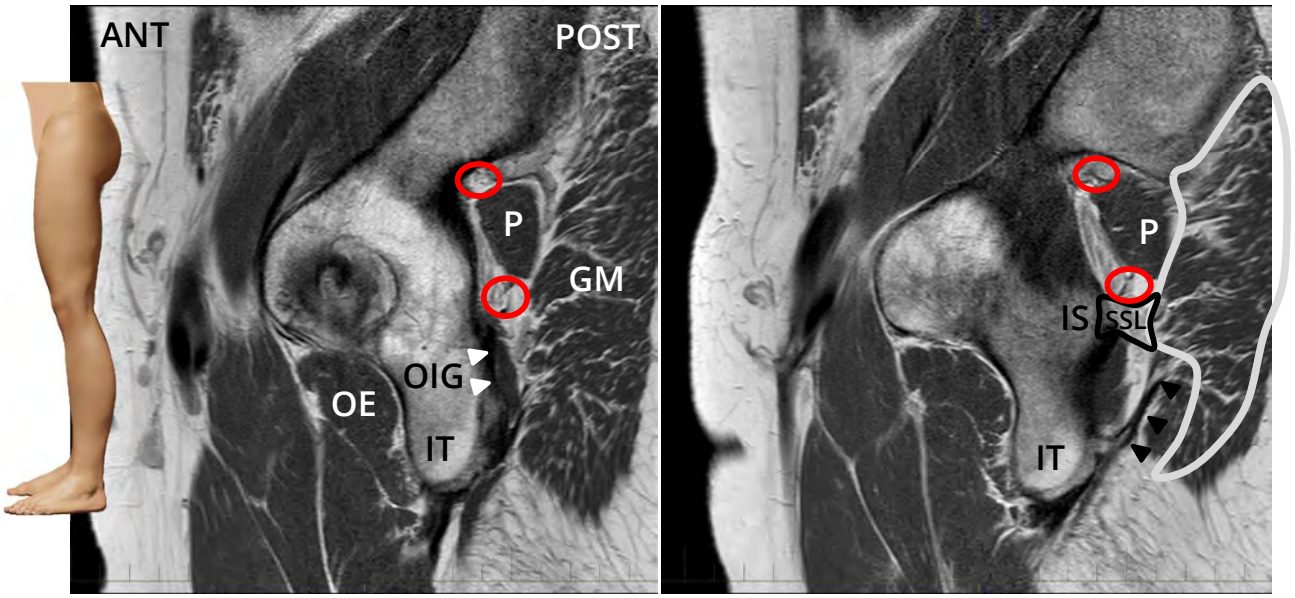
Sagittal Plane MRI's



P: Piriformis; GM: Gluteus Maximus; OE: Obturator Externus; OIG: Obturator Internus-Gemelli Complex; IT: Ischial Tuberosity; SSL: Sacrospinous Ligament

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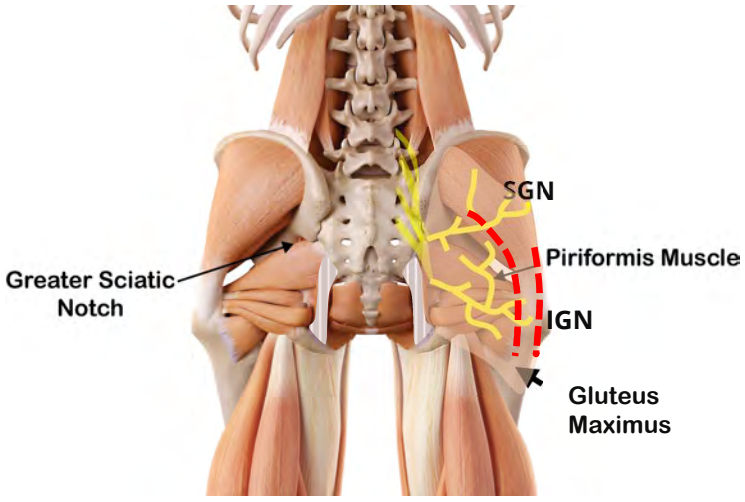
Superior & Inferior Gluteal Neuralgia/Injury



Mechanisms:

- Piriformis hypertrophy
- Trauma – pelvic #
- Iatrogenic
  a. THA – lat/a-lat/posterior
  b. Intramuscular injections
- DGS: muscles/fibrous bands
- Inflammatory neuraglia
- Vascular Abnormalities
- Tumours, cysts

SGN: Superior Gluteal Nerve; IGN: Inferior Gluteal Nerve

Florian-Rodriguez et al 2016, Hasija et al 2018, Iwanaga et al 2018, McRory & Bell 1999

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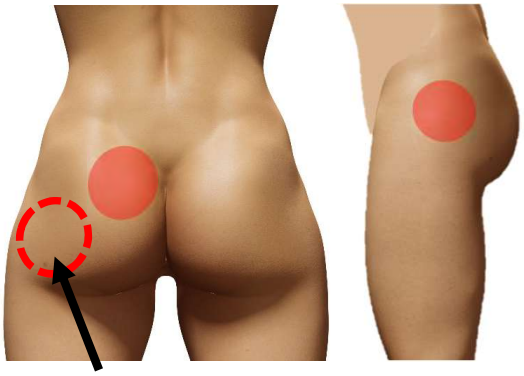
Clinical Indicators of Superior & Inferior Gluteal Neuralgia/Injury

Interview Features:

- Pain most likely to develop in the region of the nerve entrapment or injury
- May note weakness or a limp, or functional difficulties with single leg loading or hip extension functions
- May be small area of sensory disturbance if IGN involved
- Agg factors: Pain often aggravated by weightbearing activity – walking, squatting, stairclimbing



Area of sensory disturbance for IGN

IGN: Inferior Gluteal Nerve

Diop et al 2002

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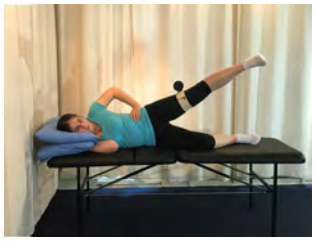
Clinical Indicators of Superior & Inferior Gluteal Neuralgia/Injury

Physical Features:

Muscle Wasting & Motor Disturbance

Pain Provocation



SGN: Abd Weakness

Function; Active ROM; Strength Test

IGN: Ext Weakness

Function; Active ROM; Strength Test

Seated Piri Stretch Test

Active Piri Test

IGN: Inferior Gluteal Nerve; SGN: Superior Gluteal Nerve; Piri: Piriformis

Diop et al 2002, Martin et al 2015

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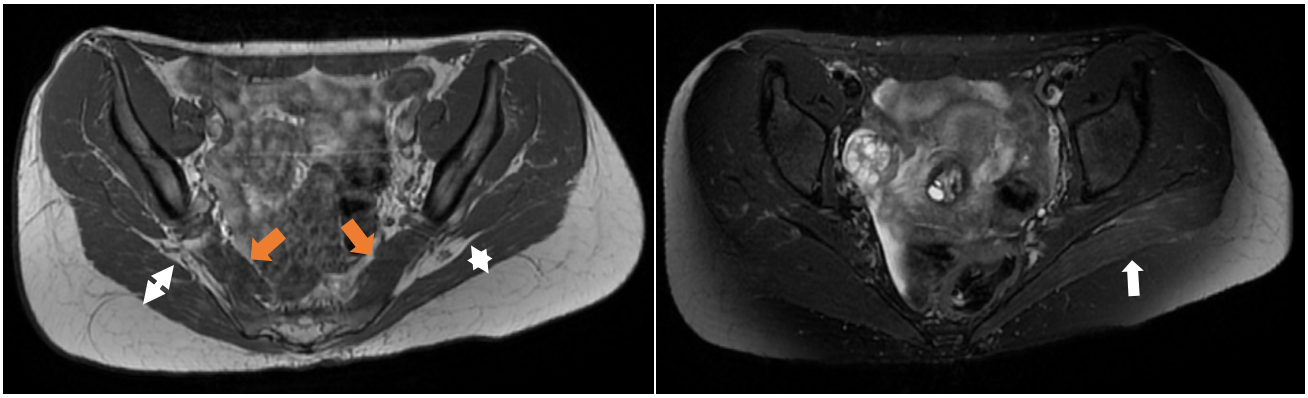
Imaging Features – Inferior Gluteal Nerve Entrapment



Gluteus Maximus wasting & increased signal intensity

Acute/subacute denervation – high signal intensity on T2 or STIR images
Chronic denervation (>6 months) – increased signal on T1 as well

Kamath et al 2008

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Management of Superior & Inferior Gluteal Neuralgia/Injury

Medical Mx: Diop et al 2002, Donofrio et al 1998, Mondelli et al 2008, Rask 1980

- Rest, monitor
- LA/CSI
- Surgery – decompression; & prevention of iatrogenic injury

Non-Medical Mx:

- Load management
- NMES – neuroelectrical muscle stimulation
- Exercise therapy – take care to avoid agg with piri stimulus, aim to lengthen & relax piri, not hypertrophy
- Neurodynamic exercises – sliders
- Manual therapy as adjunct - avoid aggressive pressure in greater sciatic foramen

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Non-sciatic neuralgia of the lateral hip & buttock

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Neuralgia in the lateral hip region
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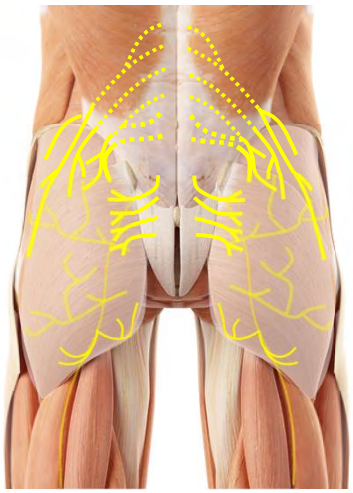

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