ASSOCIATION OF POSTERIOR CRUCIATE LIGAMENT INJURY IN DIFFERENT TYPES OF FEMUR FRACTURE IN HOSPITAL ALOR SETAR KEDAH, A CROSS SECTIONAL STUDY

By

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To

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LIST OF ABBREVIATIONS

ACL	Anterior Cruciate Ligament
PCL	Posterior Cruciate Ligament
MRI	Magnetic Resonance Imaging
CT SCAN	Computerized Tomographic Scan
MCL	Medial Collateral Ligament
LCL	Lateral Collateral Ligament
PLC	Posterior Ligamentous Complex
TT	Tibial Tuberosity
POST	Posterior
ANT	Anterior
OA	Osteoarthritis

KAJIAN MENGENAI HUBUNGAN KECEDERAAN LIGAMEN KRUSIAT POSTERIOR DENGAN PELBAGAI JENIS PATAH TULANG PAHA DI HOSPITAL SULTANAH BAHIYA, ALOR SETAR KEDAH.

ABSTRAK

Kecederaan kepada ligamen krusiat posterior bersama patah tulang paha di sebelah yang sama susah dikenalpasti pada waktu kecederaan awal. Kadar berlakunya kecederaan ini mempunyai variasi yang luas dan insiden di Malaysia tidak diketahui.

Dengan memahami kaitan serta kekerapan berlakunya kecederaan ligamen krusiat posterior bersama patah tulang paha, kes-kes ini dapat dikesan pada peringkat awal serta dapat dirawat dengan baik. Tujuan utama rawatan adalah untuk mengurangkan sakit dan menstabilkan lutut serta mengurangkan risiko kecerderaan pada selaput sendi. Tujuan in boleh dicapai sekiranya kecederaan ini dapat dikesan awal dan rejimen fisioterapi dapat dimulakan.

Kajian ini melibatkan seramai 144 pesakit. Daripada jumlah ini, 45 pesakit mengalami kecederaan patah tulang paha bahagian atas, 62 pesakit megalami kecederaan patah tulang paha bahagian tengah dan 37 pesakit megalami kecederaan patah tulang paha bahagian bawah. Seramai 13 orang pesakit daripada jumlah terlibat dalam kajian ini mempunyai kecederaan PCL (9%).

Berdasarkan kajian kami, 6 daripada 13 kes kecederaan PCL tersebut dikesan lewat dengan kecederaan, satu kes telah dikesan 9 minggu selepas kecederaan dan 1 kes dikesan 10 minggu selepas kecederaan. Baki 7 kes kecederaan PCL dikesan awal. Daripada 7 tersebut,

5 adalah kecerderan ‘avulsion’ yang dikesan dengan penilaian x-ray dan 2 lagi kes berjaya dikesan kerana pemeriksaan lutut di dewan bedah selepas pembedahan keatas tulang paha.

Peratusan kecederaan PCL dengan patah tulang paha adalah 9%. Kebanyakan kes kecederaan PCL berlaku bersama patah tulang paha berhampiran sendi lutut. Sebahagian besar kes-kes yang tidak dikesan awal berlaku kerana kegagalan melaksanakan pemeriksaan lutut lengkap di dewan bedah selepas pembedahan keatas tulang paha selesai. Kami mengesyorkan semua pesakit yang mengalami patah tulang paha dan menjalani pembedahan perlu menjalani pemeriksaan lutut yang lengkap ketika masih diberi ubat buis. Untuk semua pesakit, terutamanya dengan patah tulang paha berhampiran dengan sendi lutut harus diperiksa sekali lagi semasa lawatan ke klinik selepas keluar dari wad.

ASSOCIATION OF POSTERIOR CRUCIATE LIGAMENT INJURY IN DIFFERENT TYPES OF FEMUR FRACTURE IN HOSPITAL ALOR SETAR KEDAH, A CROSS SECTIONAL STUDY

ABSTRACT

Posterior Cruciate injury in association with ipsilateral femur fracture has been historically underdiagnosed as many cases are missed during the initial trauma. The incidence or proportion of this injury has wide variation and the incidence in our setting is not known.

Understanding the proportion and association of posterior cruciate injury with femur fracture enables us to detect the injury early and treat the injury accordingly. The aim of treatment to provide a stable and pain free knee while minimalizing the risk of OA. This aim can achieved if the injury is picked up early so than an early physiotherapy regime can be started.

There were total 144 patients included in this study. From this total number 45 patients sustained proximal femur fracture, 62 patient sustained mid shaft fracture femur and 37 of them sustained distal femur fracture. From this 144 patient, 13 patients had PCL injury (9%).

Based on the study, 6 out of 13 cases of PCL injury with femur fracture were detected late with one case was detected 6 weeks after injury, three cases were detected 8 weeks after injury, one case was detected 9 weeks after injury and 1 case was detected 10 weeks after injury. The remaining 7 cases of PCL injury was detected early. Out of the 7, 5 were avulsion

injury which was picked up by x-ray during the initial assessment and the other 2 were picked up following the fixation of femur.

The proportion of PCL injury with femur fracture is 9% in our setting and distal 3rd femur fracture have higher incidence. Majority of the cases that were missed was due to failure to perform complete knee examination following fixation. We strongly recommend all patient undergoing femur fracture fixation should undergo complete knee examination while still under anaesthesia. These patient, especially with distal 3rd femur fracture should also be repeatedly screen during clinic their follow up.

1.0 INTRODUCTION

The incidence of PCL injury historically been under diagnosed as many cases are often missed during the initial assessment. Fracture femur being the one of the commonest long bone fracture encounter in the accident emergency setting. It is reported in the United States that the incidence of femur fracture is 37.1 per 100,000 person-years (Arneson TJ, 1988). Simultaneous knee injury is frequently seen in patients with femoral fractures (Moore TM, 1988). These accompanying injuries can be easily missed during early management; since the physician or orthopaedic surgeon's attention is usually focused on the initial injury (Auffarth A, 2009).

There is wide variation in the reported incidence of major ligamentous disruption of the knee in association with ipsilateral femoral shaft fracture, from as low as *4.5%* to as high as *52%* (MH., 1975) (Szalay MJ, 1990) (Walker DM, 1980). In view of this, the true incidence and proportion of PCL injury in combination with femur fracture is unknown in Malaysian setting. Several series have described intrinsic healing potential of the PCL, return to competitive sport, lack of symptomatic instability, and good outcomes at mid- term follow-up (Van de Velde SK, 2009) (Skyhar MJ, 1993). More recently, however, biomechanical studies have identified alterations in contact area and loads after PCL injury, particularly with flexion beyond 70 degrees (Skyhar MJ, 1993). These effects occur in the medial and patello-femoral compartments and some clinical series also suggest progressive disability and degenerative joint disease with chronic PCL deficiency (Van de Velde SK, 2009) (Skyhar MJ, 1993). The progression of the degenerative joint disease can be prevented with proper and early

physiotherapy. Thus by understanding the association of the injury with different types of fracture femur, it will enable us to diagnose the injury more reliably so that it can be detected in acute setting or as early as possible so that early treatment either operative or non-operative by means of physiotherapy can be initiated.

Currently some centres still use stainless steel implant for the treatment of fracture femur due to financial constraint. If stainless steel implant is used for the femur fixation and later on examination if PCL injury is detected and MRI is needed to confirm diagnosis, the MRI can be done only after the implant is removed. So by identifying the association of PCL injury with different types of femur fracture we are able to advocate the use of MRI friendly in high risk cases. This will not only be cost effective but also reduce the number of surgeries required by the patient.

2.0 LITERATURE REVIEW

Posterior cruciate Ligament injury in combination with fracture femur typically occurs with high energy trauma. As mention earlier there is wide variation in the reported incidence or proportion of major ligamentous disruption of the knee in association with ipsilateral femoral shaft fracture, from as low as *4.5%* to as high as *52%* (Szalay MJ, 1990) (Walker DM, 1980) (MH., 1975).

The wide variation in the reported cases can be attributed to the fact that the mobile fracture segment makes it difficult to carry out clinical examination to detect the injury (Auffarth A, 2009). Other factors that contribute to this wide variation is the severe pain and muscle spasm associated with fracture femur which makes clinical examination difficult (Auffarth A, 2009).

The commonest cause of long bone fracture is motor vehicle accident (MVA) and the commonest bone involved is femur (Arneson TJ, 1988). Singer et al, 1998 published that there are two critical peak of incidence in femur fracture. The first are young adult (15 to 34 years old) and second is elderly (over the age of 70 years old). There younger age group fracture is attributed to high energy trauma where as in the elderly, it is caused by low energy trauma.

The occurrence of simultaneous knee injury is commonly seen in femur fracture (Moore TM, 1988). Over the past few year many different type of studies been published describing the occurrence of ligamentous knee injury in association of fracture femur (Moore

TM, 1988) (Walker DM, 1980) (Szalay MJ, 1990). However almost all of this studies were carried out in western and developed countries and moreover most are regarding ACL. In view of this there is no established data in developing countries.

2.1 ANATOMY OF PCL

The Posterior cruciate ligament (PCL) is one of the two cruciate ligament present in the knee joint. It is an intra-articular but extrasynovial ligament of the knee joint. It extends from a broad semicircular area on the lateral aspect of the medial femoral condyle and it project to a sulcus that is posterior and inferior to the articular plateau of the tibia.

Like the ACL, the PCL also consist of two bundles: a larger anterolateral bundle, and a smaller posteromedial bundle. The anterolateral bundle is tight in flexion, and the posteromedial bundle is tight in extension (fig. 1)1. (Johnson CJ, 1990). The anterolateral bundle is 2 times larger and stronger than posteromedial bundle (Lopes OV, 2008).

The average length and width at its midportion, as reported by Girgis et al., are 38 and 13 mm, respectively (Girgis FG, 1975) . The PCL cross-sectional area is 50% greater than the ACL at the femur and 20% greater at the tibia. The origin of the ligament is from a broad crescent shaped area on the anterolateral aspect of the medial femoral condyle (Girgis FG, 1975). At its insertion over the posterior tibia, just 1 to 1.5 cm below the articular surface, the anterolateral bundle takes a surface area of 93.1mm2 and the posteromedial bundle takes a surface area of 150.8mm2 (Tajima G, 2009).

The PCL is supplemented by two accessory ligaments. These two ligaments are knows as the anterior and posterior meniscofemoral ligaments, they extend from the posterior horn of the lateral meniscus and insert anterior and posterior to the PCL onto the medial femoral condyle. These are termed the ligaments of Humphrey and Wrisberg, respectively, and they

are not present in all knees. They average approximately 22% of the entire cross-sectional area of the PCL (Harner CD J. M., 2000) . They serve as secondary stabilizers to posterior tibial translation.

The blood supply to the PCL is mainly by the middle genicular artery which is branch of the popliteal artery given posterior to the knee joint and it pierces the oblique popliteal ligament to supply the ligament. The PCL also receives blood supply from the inferior medial and lateral genicular artery via the fad pad (SP, 1983).

The PCL is innervated by posterior articular nerve which is branch of tibial nerve ant the obturator nerve. This nerve supply primary provide propprioceptive sense. This proprioceptive sense that help protect the knee joint during use (Kennedy JC A. I., 1982).

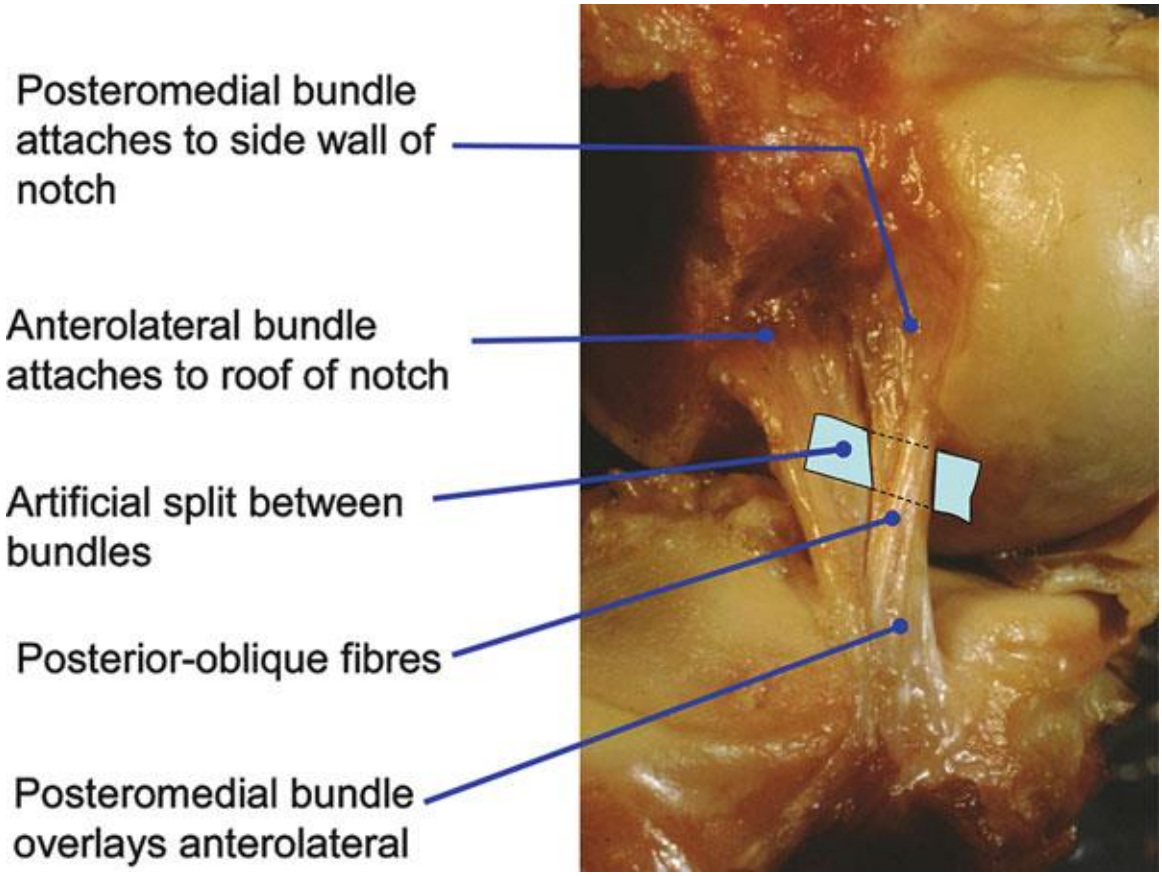
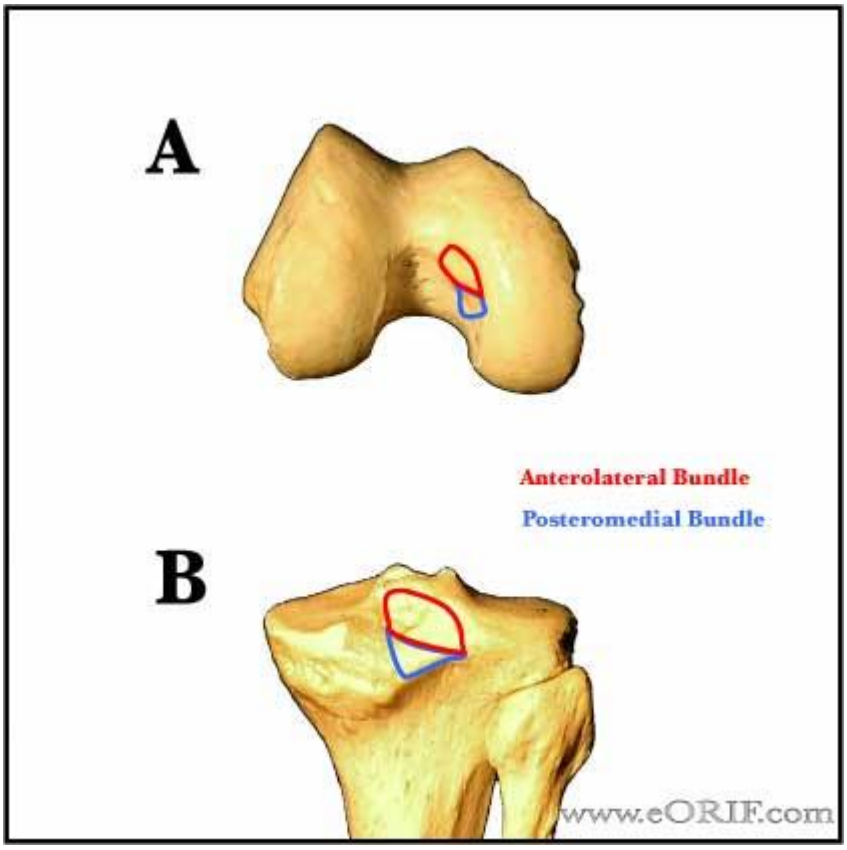


Figure 1 Anterior view of cadaveric specimen showing the two bundles of the PCL and the attachment sites on the femur (Johnson CJ, 1990) .



A- Oblique view of femoral notch.

B- Posterior view of proximal tibia.

Figure 2 PCL attachment sites on the femur and tibia (Tajima G, 2009).

The primary function of PCL is to prevent posterior translation of tibia in relation to femur in any degree of flexion and it is a secondary stabilizer against external of tibia, as well as for excessive valgus or varus angulation of the knee.

2.2 PCL INJURY

2.2.1 MECHANISM OF INJURY

The Posterior cruciate ligament is the stronger of the two cruciate ligaments, which means that high energy is required to cause the injury. There are two main types of mechanism causing PCL injury. The commonest is the so called ' dash board injury (Kannus P, 1991). This type of mechanism is commonly seen in motor vehicle accident where the knee in flexion strikes the dash board, producing a posterioly directed force displacing the tibia posterioly to cause a substance tear or PCL avulsion fracture (Kannus P, 1991).

The second mechanism of injury is commonly seen in sport related injury. The mechanism involves direct fall onto flexed knee with the foot in plantar flexion. In this type of injury, the posterior force is directed to the tibial tuberosity causing posterior displacement of the tibia (Parolie JM, 1986). A dorsiflexed foot has a protective effect as it transmits the force through patella and distal femur, protecting the PCL from injury (Amis A., 2006).

Other mechanism that has been reported is hyperextension of knee producing PCL injury which also commonly associated with posterior capsule tear (Prietto MP, 1988). An excessive valgus and varus force may also produce PCL injury as mention earlier that PCL is a secondary stabilizer for valgus and varus force.

2.2.2 BIOMECHANICS

The understanding of the biomechanics of posterior cruciate ligament is very important to help us understand the basic of clinical knee examination. This knowledge is obtained from selective cutting of ligament followed by stimulated knee examination. This experimental change in laxity from selective ligament cutting provide important information regarding clinical knee testing (Skyhar MJ, 1993).

Gollehon et al in their experimental study used the selective ligament cutting techniques to evaluate the role of PCL and the posterolateral corner in stability of the knee (Gollehon DL, 1987). Their conclusion was, after selective sectioning of the only PCL there was increased posterior translation at all angles of flexion with the maximal occurring beyond 90 degrees. Isolated sectioning of PCL did not increase varus angulation but the varus angulation increased significantly especially at 30 degrees with combination of PCL and deep ligament complex (arcuate ligament, popliteus tendon, fabellofibular ligament, and posterolateral capsule) (Gollehon DL, 1987). The combination sectioning of PCL and deep ligament complex (arcuate ligament, popliteus tendon, fabellofibular ligament, and posterolateral capsule) also markedly increased external rotation at 60 and 90 degrees of flexion (Gollehon DL, 1987).

The tensile strength of the PCL has been reported in various literature by a number of investigators: Kennedy et al. 1051 N (Kennedy JC H. R., 1976), Marinozzi et al. 855 N (Marinozzi G, 1983), Prietto et al. 1627 N (Prietto MP, 1988), Trent et al. 739 N (Trent PS, 1976). The reason that the reported strength varies from each other is because the PCL fibres act in different directions, and so a uniaxial test of the whole ligament may have caused a