

**CLINICAL AUDIT ON PERTHES DISEASE
TREATMENT IN HOSPITAL UNIVERSITI
SAINS MALAYSIA FOR PAST 20 YEARS**

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ABSTRAK

Pengenalan

Penyakit Perthes adalah penyakit gangguan bekalan darah pada kepala tulang peha yang tidak di ketahui penyebabnya. Dengan kembalinya bekalan darah menyebabkan kepala tulang peha menjadi lembut dan kerosakan bentuk. Pemulihan kepala sendi bergantung kepada keterukan penyakit dan juga masa serta bentuk rawatan yang diterima pesakit . Kami menilai semua kes yang di rawat di pusat kami untuk mengetahui gambaran klinikal pesakit dan juga hasil akhir rawatan.

Metodologi

Kami telah mengkaji semua pesakit Perthes yang dirawat di hospital kami dari tahun 2000-2020. Pesakit dikesan dari pejabat rekod berdasarkan Klasifikasi Penyakit Antarabangsa, Semakan ke-10 (ICD -10). Maklumat klinikal yang diperlukan diperolehi dari rekod pesakit dan imej radiology dari *General Healthcare Centricitytm System (PACS)*. Temuramah telefon di lakukan untuk menilai masalah sendi pinggul. Maklumat tersebut diteliti dan dipersembahkan secara deskriptif.

Keputusan

Daripada 32 pesakit(34 sendi pinggul) sejak 20 tahun, hanya 2 daripadanya adalah melibatkan kedua dua belah sendi dan hanya 2 orang pesakit adalah perempuan. Umur semasa rawatan adalah antara 4 hingga 12 tahun dengan 19 (59.4%) dari mereka adalah 8 tahun atau lebih. Lima pesakit mempunyai masalah sendi *hinge abduction*. Dua pesakit datang dengan peringkat iskemia, 29 pada peringkat fragmentasi dan satu pada peringkat lewat fragmentasi. Empat sendi di kategori *Herring A*, 16 sendi di kategori *Herring B* dan 14 sendi di kategori *Herring C*. Dalam kalangan 22 pesakit yang mempunyai rawatan susulan sehingga tulang

matang, 7 sendi di kategorikan sebagai *Stulberg A*, 12 sendi di kategorikan *Stulberg B* dan 3 sendi di kategorikan *Stulberg C*.

Dalam kalangan 14 belas pesakit yang menajalani pembengkokan tulang peha dan mempunyai penilaian akhir tulang matang, 5 daripadanya mempunyai hasil akhir *Stulberg A* dan 9 hasil akhir *Stulberg B* dan tiada pesakit mempunyai hasil akhir *Stulberg C*. Dalam kalangan 2 pesakit yang di rawat dengan arthrodiatasis, satu daripadanya mempunyai hasil akhir *Stulberg B* dan seorang lagi mendapat *Stulberg C*. Sepuluh pesakit (12 sendi) yang di rawat dengan kaedah tanpa pembedahan tidak menunjukkan keputusan konsisten.

Dalam kalangan 5 pesakit sendi *hinge abduction*, sendi 4 orang telah mendapat kemasukan sendi apabila dibius dan dirawat dengan pembengkokan tulang peha. Sendi satu pesakit tidak dapat masuk dan dirawat dengan *artrodiathesis*. Kesemua 5 pesakit tersebut mendapat hasil akhir *Stulberg B*. Daripada 21 pesakit yang mempunyai radiografi pada umur matang, 17 pesakit yang mempunyai *Herring B* atau *Herring C* mempunyai pembesaran tulang greater trochanter lebih daripada 0.5cm. Tiada pesakit yang mempunyai kategori *Herring A* mendapat pembesaran tulang *greater trochanter*.

Kesimpulannya

Terdapat ramai pesakit yang datang lewat berbanding awal semasa rawatan. FVO menghasilkan keputusan akhir yang baik walaupun pesakit datang pada umur melebihi 8 tahun. Rawatan pembendungan menggunakan cast pantaloon menghasilkan keputusan yang tidak tepat. Pesakit dengan masalah *hinge abduction* mendapat faedah dengan rawatan FVO jika sendi pinggang menjadi terbandung dengan traksi dan pelepasan adductor. Rawatan pencegahan epiphysiodesis tulang *greater trochanter* bergantung kepada cara ia lakukan dan umur pesakit

Kata Kunci:

Herring, pembesaran greater trochanter, pembengkokan tulang peha, penyakit Perthes, hinge abduction

ABSTRACT

Introduction

Perthes disease is avascular necrosis of femoral head due to unknown cause. The spontaneous revascularisation will cause femoral head to be soft and possible deformed. The outcome of the disease will depend on severity of disease as well as how and when the treatment are provided. We review all the cases treated in our institution to know the pattern of presentation and outcome of treatment.

Methodology

We reviewed all Perthes disease patients treated in our hospital from 2000 -2020. Patients were traced based on International Classification of Disease, 10th Revision (ICD -10). The required clinical information was obtained from patients record and General Healthcare Centricity™ picture archiving communication system (PACS). Phone interview was used to asceses the hip symptom. The information was scrutinized and presented with descriptive manner.

Results

Out of 32 patients(34 hips) , there were only 2 patients presented with disease of both hips and only 2 patients were female. Age of presentation varies from 4-12 years and 19 (59.4%) of them were 8 years or older. Five patients presented with hinge abduction. Two patients presented at ischemic phase, 29 patients presented at fragmentation phase and one patient presented at late fragmentation phase of the disease. Four hips presented with Herring A, 16 patients presented with Herring B and 14 presented Herring C. Out of 22 hips who were followed up until maturity, 7 hips had Stulberg A, 12 hips had Stulberg B and 3 hips had Stulberg C.

Out of fourteen patients with femoral varus osteotomy (FVO) for containment procedure and followed up until maturity, 5 patients had Stulberg A and 9 patients had Stulberg B and no patient had Stulberg C. Out of two patients underwent arthrodiastasis for containment, one resulted with Stulberg B and another patient resulted with Stulberg C. Ten patients (12 hips) that were treated with non-operative treatment did not show consistent outcome .

Among 5 patients with hinge abduction, 4 of them were containable under general anaesthesia and treated with FVO. One patient could not be contained under general anaesthesia and treated with arthrodiastasis. All of them had Stulberg B at maturity. Out of 21 patients with radiograph at maturity, 18 patients with Herring B or C had greater trochanter overgrowth of more than 0.5 cm and the remaining 3 patients with Herring A did not have greater trochanteric overgrowth.

Conclusion

There were bigger number of patients with late onset compare to early onset . FVO produces a reasonable outcome even in patient of older than 8 years old. Containment with panthaloone cast abduction brace produce unpredictable outcome. Patients with hinge abduction benefit FVO if the hips become containable with traction and adductor release. Prophylaxis by mean of greater trochanter epiphysiodesis depends on the method and age of patient.

Key Words: Herring lateral pillar, Greater trochanteric overgrowth, containment, FVO, Perthes disease, hinge abduction

CHAPTER 1:INTRODUCTION

1.1 INTRODUCTION

Perthes disease, an idiopathic avascular necrosis of femoral head in paediatric population, is self-limiting disease . The affected femoral head undergoes changes from avascular necrosis, revascularization and remodelling [1]. The outcome varies from remodelling to a normal head, mild form or severe deformity that lead to development of early osteoarthritis. The cause and treatment is still controversial. The incidence is about 0.4/100,000 to 29.0/100,000 in children less than 15 years of age [2].

Most of patients presented with limping either due to limited hip movement or hip pain. The majority of the patients come for treatment at older age with more severe hip involvement according to lateral pillar classification. During revascularization phase, the femoral head is soft if it is not well contained in the acetabulum, part of the head may get deformed and eventually remodelled with deformity that may cause limited range of motion and early osteoarthritis. The management of Perthes disease during fragmentation phase is containment. The method of containment depend on surgeon preference, age of patient and severity of disease. The outcome also depend on the above factor. Compliance of patients would be the additional factor especially if they are treated with brace. Therefore it is very important to review result of our treatment of patients in our country.

Most of our patients underwent surgical containment by femoral varus osteotomy(FVO) or containment by bracing . Thus we need to know the outcome of our treatment.

Hinge abduction is one of the sequelae of late presentation of Perthes disease and the treatment is controversial. We have done arthrodiastasis in few patients who presented late with hinge abduction. They required review of the outcome.

Overgrowth of greater trochanter is one of the complication of Perthes disease that lead to limited abduction and Trendelenburg gait. We have done prophylaxis epiphysiodesis that need an outcome review.

The study was designed to review the outcome based on radiograph and to assess the functional and put them on Womac functional score available.

CHAPTER 2 : OBJECTIVE OF THE STUDY

2.1 General objective

To study outcomes of Perthes disease treated in Hospital USM

2.2 Specific Objectives

- 1.To describe the clinical presentation of Perthes
- 2.To determine the outcome of surgical containment
- 3.To determine the influence of age at the time of osteotomy on the outcome
- 4.To determine outcome of treatment in cases with hinge abduction
- 5.To determine outcome of prophylaxis greater trochanteric epiphysiodesis

CHAPTER 3: MANUSCRIPT

3.1 TITLE

CLINICAL AUDIT ON PERTHES DISEASE TREATMENT IN HOSPITAL UNIVERSITI SAINS MALAYSIA FOR PAST 20 YEARS

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3.2 ABSTRACT

Introduction

Perthes disease is avascular necrosis of the femoral head due to an unknown cause. The revascularisation will cause femoral head to be soft and possibly deformed. The outcome of the disease will depend on the severity of the disease as well as how and when the treatment are provided. We reviewed all the cases treated in our institution to identifying the pattern of presentation and outcome of the treatment.

Methodology

We reviewed all Perthes disease patients treated in our hospital from 2000 -2020. Patients were traced based on International Classification of Disease, 10th Revision (ICD -10). The required clinical information was obtained from patient's record and General Healthcare Centricity™ picture archiving communication system (PACS). Phone interview was used to assess the hip symptom. The information was scrutinized and presented in a descriptive manner.

Results

We have treated 32 patients(34 hips) for the past 20 years. There were only two patients who presented with the disease of both hips and out of the 32 patients only two were female. Age of presentation varies from 4-12 years with the mode of presentation were 9 years. Five patients presented with hinge abduction. Two patients presented at ischemic phase, while 29 patients presented at fragmentation phase and one patient presented at late fragmentation phase of the disease. Four hips presented with Herring A, 16 patients presented with Herring B and 14 presented Herring C.

In general, out of 22 hips (both operative and non operative) who were followed up until maturity, 7 hips had Stulberg A, 12 hips had Stulberg B and 3 hips had Stulberg C. Eighteen patients had greater trochanter overgrowth of more than 0.5 cm

Ten patients (12 hips) underwent non operative treatment, however the outcome were not consistent. Twenty patients underwent FVO for containment procedure. Five of 14 patient who were followed up until maturity had Stulberg A and 9 of them had Stulberg B. There was no patient with Stulberg C. Two patients underwent arthrodiastasis for containment procedure and ended with Stulberg B and C, respectively.

There were five patients with hinge abduction, four of them were treated with FVO and one was treated with arthrodiastasis. All of them had Stulberg B at maturity.

Patient with Herring A at presentation did not show any greater trochanteric overgrowth. Trochanteric overgrowth occurred only in patient with Herring B and C. Prophylaxis greater trochanter epiphysiodesis were done in three patients and was successful in one patient but failed in the other two patients.

Conclusion

In conclusion, we found that more than half of our Perthes patients were presented at the age of 8 or older. Containment by femoral varus osteotomy (FVO) produce reasonable outcome even in patients between 8 to 12 years old. Containment with panthaloan cast was unpredictable due to compliance to prolong usage. Treatment of patients' hinge abduction was based on its contain-ability under general anaesthesia and muscle relaxant gave a reasonable outcome. Primary epiphysiodesis could prevent greater trochanter overgrowth, however its outcome depend on the technique of procedure and age.

Key Words: Herring lateral pillar, Greater trochanteric overgrowth, containment, femoral varus osteotomy, Perthes disease, hinge abduction

3.3 INTRODUCTION AND JUSTIFICATION OF STUDY

Perthes disease, an idiopathic avascular necrosis of femoral head in pediatric population, is self limiting disease . The affected femoral head undergoes changes from avascular necrosis, to fragmentation and remodelling [1]. The outcome would be varies from remodelling to a normal head, mild formation or severe deformity that lead to development of early osteoarthritis. The cause and best treatment are still controversial for the management of Perthes disease. Prevalence of the disease is about 0.4/100,000 to 29.0/100,000 in children less than 15 years of age [2].

Most of the patients presented with limping either due to limb length discrepancy (LLD), stiffness or pain. In advance stage they can present with trendelenburg gait. Radiological features at presentation also varies. Catterall and Herring Lateral Pillar classification are common classification used to look for epiphyseal and lateral involvement respectively.

Treatment of Perthes disease in different centres might be different and comparison of outcome between the method might be difficult [3].

The management of Perthes disease is containment during fragmentation phase for cases with risk of deformity. The best time for containment is an early as possible [4]. Joseph B emphasised that the surgery was to be done before advance stage of fragmentation and did not mention about age [5].

There has been condition patient presented with advance stage of disease with hinge abduction making a more complex management. We performed arthrodiastesis procedure for the patient . Athrodiasthesis with soft tissue release in patient hinge abduction resulted in the disappearance of head deformity of Perthes disease [6].

Overgrowth of greater trochanter is one of the complication of Perthes disease that lead to shortened and weaken abductor muscle and some patients may present with limited hip abduction. Primary trochanteric epiphysiodesis together with varus osteotomy was recommended [5]. However, the epiphysiodesis of greater trochanter in patient over the age of 8 years old was not effective compared to below 6 years old [7]. Another option for overgrowth of trochanter is trochanteric advancement, that has been advocated when there is minimal trochanteric overgrowth [8].

This medical audit was conducted to review clinical features including age and stage at presentation of perthes disease. It was also aimed at finding the outcome of treatment in our centre.

3.4 METHODOLOGY

This is an audit on Perthes disease patients treated in Hospital Universiti Sains Malaysia (HUSM). The list of patients were obtained from the record office according to ICD 10 classifications of disease with the diagnosis of Perthes disease in our centre from 2000 until 2020.

Patients' record were obtained from the record office and were studied. Age of patients at presentation, gender, presenting symptom and treatment received were recorded. Herring lateral pillar classification was classified according to lateral pillar involvement during fragmentation phase and were divided into 3. The lateral pillar make up between 15-30 % of the femoral head involvement which were taken from AP radiograph hip. Lateral pillar without disease involvement was classified as A, while group B with pillar measured between 50-100 % of original height, and group C were those measured less than 50 % of the original height. Classification were made during fragmentation phase of the disease and were based on AP radiograph [9]. The final follow up radiograph were studied and classified according to modified Stulberg classification when it reach skeletal maturity [10]. We define skeletal maturity when there is closure of physis proximal femur and triradiate cartilage [5]. Stulberg A is a spherical head, Stulberg B has an ovoid head whereas Stulberg C has flat head (appendix 2). We only take anteriorposterior pelvic radiograph for final Stulberg assesement. The relative greater trochanteric overgrowth (RGOT) were measured from the difference of articulo trochanteric distance between normal and disease hip during the final follow up [7] . All the x-ray were obtained from our PACS system. Those patients who came to clinic for the most recent follow at maturity were ascesesed on the function using WOMAX score (appendix 3). The assessment were on pain, movement and function with min grade of 0 and max grade of 96 (appendix 3)

3.5 RESULT

Clinical presentation

There have been 32 patients (34 hips) with Perthes disease treated in our hospital from year 2000 to 2020. There were only two patients presented with the disease on both hips. There were only two female patients. The age at presentation varied from 4 to 12 years of age with mode of 9 years old. Twelve patients presented at the age of 7 or younger and twenty patients presented at the age of 8 and older. Twenty patients (63%) presented with painless limp and twelve patients (37%) presented with hip pain. Among them, five patients presented with hinge abduction (Table 1).

Two patients presented at ischemic phase, 29 patients presented at fragmentation phase and one patient presented at late fragmentation phase of the disease. Four hips presented with Herring A, sixteen patients presented with Herring B and 14 presented with Herring C. Three patients had Catterall group 1, ten patients had Catterall group 2, ten patients had Catterall group 3 and 11 patients had Catterall group 4. There were 21 patients (22 hips) who had followed-up until the age of maturity. Nine patients had followed-up until age of 10-14 years old. Only two patients had a followed up to up to 9 years old or younger (table 1).

Overall outcome

Out of 22 the hips who were followed up until maturity, 7 hips had Stulberg A, 12 hips had Stulberg B and 3 hips had Stulberg C. Out of three patients with poor result (Stulberg C), two of them presented with Herring C and one of them presented with Herring B (patient no. 27). Out of twelve patients with available Womax score, 9 patients obtained score 0, 2 patients obtained score 2, 2 patients obtained score 4 and one patient obtained score 7 (table 2)

One patient (patient no. 15) presented very early at ischemic phase at the age of 10. He underwent a closed follow up treatment , FVO at fragmentation phase (Herring B) and had a very good outcome (figure 1). In contrast, another patient (patient no. 32) presented very late at the end of fragmentation phase with Catterall group 3 at the age of 12. He was treated with abduction brace only for 3 months. His final condition at maturity was Stulberg C (figure 2). The other 29 patients presented at fragmentation phase will be elaborated later according to age, severity of disease and treatment.

Outcome of surgical containment

Almost all patients (20) underwent FVO for containment procedure. The surgeries were done at fragmentation phase. Fourteen patients underwent FVO were followed up until maturity. Five of them had Stulberg A (figure 1) and nine of them had Stulberg B (figure 3) . There was no patient with Stulberg C (table 1) .

Five patients had early onset of disease, at age 7 or younger. Patient no.2 (Herring B) had final outcome of Stulberg A. Patient no.5 (Herring C), patient no.1 (Herring C) and patient no.4 (Herring B) had final outcome of Stulberg B (figure 4) . The other patients were not yet mature at the time of the study.

Fifteen had late onset of disease, at age between 8 to 12 years old. Among the eight patients with Herring B, four patients obtained Stulberg A (figure 1), two patients obtained Stulberg B (figure 5), while the other two patients did not complete follow-up till maturity. Among the six patients with Herring C, four patients obtained Stulberg B (figure 3) while the other two patients did not complete follow up till maturity (table 3)

Out of 20 patients with FVO, 12 hips were fixed with Dynamic compression plate (DCP) and 8 hips were fixed with Cannulated Paediatric Osteotomy System (CAPOS). Immediately after the surgery, the femoral offset was wider in patient who was fixed with DCP

(figure 5) compared to patient who was fixed with CAPOS plate (figure 1). However at maturity the femoral offset improved due to remodelling of proximal femur (figure 5).

Two patients underwent arthrodiastasis for containment procedure. Patient no.21 (6 years old) with Herring C underwent arthrodiastasis and was put on external fixator for 4 months. His final condition at maturity was Stulberg B (figure 6) . Patient no. 22 (9 years old) with Herring C underwent arthrodiastasis and was put on external fixator for 3 months. His hip subluxated on follow-up. His final condition at maturity was Stulberg C (figure 7). Patient no.32 underwent arthrodiastasis at remodelled stage (14 years old) after a poor outcome of improper bracing. We failed to improve the hip and final follow up at maturity showed a Stulberg C (figure 2).

Outcome of non-operative treatment

Age of onset and severity at presentation did not show a consistent outcome in the 10 patients (12 hips) who underwent non-operative treatment . The method of abduction brace was pantaloons cast. Among the six patients with age 7 years old or younger, patient no. 23 right hip (Herring B) ended up with Stulberg A, while his left hip with Herring C ended up with Stulberg B (figure 8a1 & 8a2). In contrast, patient no. 27 (Herring B) ended up with Stulberg C (figure 8b1 & b2) , patient no. 28 (Herring C) ended up with Stulberg B (figure 13). The other patients did not have follow-up at maturity

Among four patients between 8 to 12 years old, patient no. 29 (Herring A) ended up with Stulberg A, and patient no. 32 (Herring C at late fragmentation phase) ended up with Stulberg C. The other patients did not have follow up at maturity (table 4)

Outcome of treatment in cases with hinge abduction

There were five patients presented with hinge abduction. They were between 6 years old and 11 years old. All of them were admitted and were put on traction for 1-2 weeks duration. Four out of 5 underwent FVO and ended up with Stulberg B at maturity (figure 3) and (table 5). One patient (patient no. 21) was treated with arthrodiastasis and had good outcome with Stulberg B (figure 6) .

Greater trochanteric over growth

Out of 21 patients with radiograph at maturity, 18 patients had greater trochanter overgrowth of more than 0.5 cm. Two of them underwent distal transfer greater trochanter (patient no.1 and no. 18). Those patients (patient no. 6 and no.29) who presented with Herring A and radiograph at maturity of Stulberg A had greater trochanter overgrowth of less than 0.5 cm. (figure 9) . Unfortunately we do not have data whether greater trochanter transfer has improved trendelenburg gait.

The outcome of prophylaxis epiphysiodesis on 3 patients was unpredictable. Patient no. 24 with Herring B at the age of 4, underwent prophylaxis epiphysiodesis at 7 years old. The successful result was shown by no evidence of greater trochanter overgrowth at age of 12 years (figure 11). However, epiphysiodesis at age of 10 on patient no.13 (Herring C)and epiphysiodesis at age of 11 in patient no 17 (Herring C) were not successful (figure12)

3.6 DISCUSSION

Natural history

Perthes disease, an idiopathic avascular necrosis of femoral head in paediatric population, is a self limiting disease. The affected femoral head undergoes changes from avascular necrosis for a period between 6 to 12 months. Radiologically, it appears with a smaller femoral ossific nuclues and a wider cartilage space. Ossific nucleus appeared denser due to surrounding osteoporosis and new lay down on the dead bone. It is followed by revascularisation during which the dead osteoid bone is resorbed by osteoclast and osteoblast form new bone that later remodels the new femoral head. The femoral head become soft during revascularisation, pressure on the head causes microfracture, pain and further disturbance of the revascularisation thus causing recurrent ischemia in certain cases. This period is called fragmentation phase with radiographic feature of mixed radiopacity and radiolucency. This period may take two to three years. Later reossification and remodelling occurs[1]

During the revascularisation, the femoral epiphysis is “biologically plastic” and is susceptible to irreversible deformation due to weight bearing and muscular forces across acetabular ream to the femoral head [11]. In normal hip, only 57.4% of femoral is covered by acetabulum [12]. Therefore, femoral head has to be contained inside the acetabulum during this period in order to prevent form deformation, limited range of motion and early osteoarthritis.

Diagnosis and severity

The diagnosis were made based on radiograph at presentation during fragmentation phase [9]. The involvement femoral varies as stated by Catterall classification from less than 25%, between 25-50%, 50-75% or more than 75%.

It is known that Perthes disease is more common in male patient [13]. This is supported by our study that most of the affected patients were male with only 5.4 percent of cases occurred in female.

Gender and laterality

Similar to other finding, we also found that most of the patient were male and unilateral. The two female patients in our series also showed a more severe disease similar to what has been reported in the literature [2,13]. In contrast to the known fact that Perthes occurs in relatively small size patient [36], however our two female patients were overweight.

Age of onset and presentation

The age of onset and time of presentation are among the important predictor factors of final outcome of Perthes disease [14]. Patients usually brought to the hospital after having pain due to micro fracture in early fragmentation phase. Painless limp or stiffness occurred at late fragmentation or remodelling phase. In our study, 29/32 (90.6%) patients presented at fragmentation phase. We can conclude that majority of our patient presented at late fragmentation phase as 20 patients (63%) presented with painless limp. Joseph et al found that only half of 64 patients who presented after 12 years old were at stage of fragmentation [16]. It is however difficult to ascertain the onset of disease because since time taken for a patient to go through each phase of disease varies from months to years. Loder et al, reported that average presentation was around 6.5 years old and range from 4-8 years old [2]. However, we found that 62.5% of our patients presented at the age of 8 years old or more with fragmentation phase. Based on the statement by Herring et al that the fragmentation phase of the disease was 9 months [15] we concluded that a significant number of Perthes disease in our population had late onset of disease. It is known that disease presentation varied among the country, cities, and ethnic group [2]. Genetical, environmental or cultural factor may play a significant role as discovered by Ben Joseph et al that there were also occurrence of Perthes disease in India among older population [16,17].

Management

The age of presentation and stage of disease are among the important predictor factor of the final outcome of Perthes disease [14]. Current method of treating Perthes disease in attempt to prevent head deformation is by containing the femoral epiphysis in the acetabulum during the period of fragmentation. It can be achieved by either surgery or abduction brace especially for those with head at risk sign [18]. Heikkinen et al emphasised that it is important to perform the containment procedure (FVO) as early as possible [4]. We have done intervention (containment) in fragmentation stage in most of our patient either with surgery or without surgery and majority of them 19/22 have good result with Stulberg A or B. Once diagnosis of Perthes disease were made in our patient, we admitted patient who needed surgery to ward and for containment procedure.

Age and severity

Younger patient tends to have less lateral pillar involvement and has time for healing and ended up with more spherical femoral head. Elder patient with more severe lateral pillar involvement making more time for re ossification and flattening of femoral head [9]. Containment procedure either by FVO or brace after the age of 8 years old did not guarantee a good significant head improvement when compared with no treatment group [19] . However, they found the only shelf acetabuloplasty will prevent further head deformation from initial presentation. More recent evidence had shown good outcome of containment procedure in patient age of more than 8 years old [20]. Out of 20 patients presented at the age of 8 to 12 years old, 2 with herring A, 10 with herring B 10 and 8 with herring C 8. Fifteen of them were treated with FVO. Ten of them were followed up until maturity and had Stulberg A or B. With this finding, we agree with Joseph B et al suggestion to do containment on the early fragmentation phase in order to prevent head deformation from occur without emphasising the age[1].

Method of containment

Herring et al found that patients who were 8 years old or less at the onset of the disease did equally well with nonoperative and operative treatment provided they were in lateral pillar group B. However, the outcomes of surgical treatment were significantly better than those of nonoperative treatment in children over the age of 8 years at the onset of the disease[21].

Our result on a few patients that were treated with abduction cast did not obtain a consistent outcome. The detail data showed that those patients were only on short period of cast brace. It is very difficult to get a child to put on a brace for one to two years in a hot climate like Malaysia.

We therefore, recommended femoral osteotomy as containment procedure to ensure femoral head remained in the acetabulum through the period of revascularisation. Another choice of surgical containment , innominate osteotomy, was known to maintain neck shaft angle, length and abduction movement[22] . We preferred FVO due to its simpler technique that can be done by almost any orthopaedic surgeon. The slight shortening following the femoral varus osteotomy may give further hip containment due to pelvic tilt [23]. Limb length discrepancy has not been causing significant problem because the remodelling of deformity and overlengthening that usually occurred within the period of 3 years after surgery[24]. Herring et al found no differences in the hip outcome between those treated with a femoral varus osteotomy or an innominate osteotomy [21] . Osman et al, found that shelf acetabuloplasty was able to prevent further head deformation from initial presentation patient with age of 8 years or older[19].