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Review

Acute total hip replacement for acetabular fractures: A systematic review of the literature

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ABSTRACT

Introduction: Immediate total hip replacement (THR) in patients with acetabular fractures is controversial because of concerns about high complication rates. The current article is a systematic review of the literature on the use of acute THR for the treatment of acetabular fractures.
Materials and methods: This systematic review included studies published in English between 1992 and 2012 of subjects with acetabular fracture undergoing immediate THR. Outcomes of interest included indications; clinical assessment, including walking ability; comparison with control group; associated procedures, and rate of complications, such as loosening or revision surgery.
Results: This review identified six studies, of which only one included a control group. Acute THR was associated with satisfying outcomes with regard to clinical assessment and walking ability. The comparative study assessed the difference between acute THR and delayed THR in acetabular fractures: improved outcomes were observed in the delayed THR group, although the differences between the two groups were not statistically significant.
Discussion: According to data reported in the literature, acute primary THR can be successful in patients with poor bone quality, combined acetabular and femoral neck fractures, or pathological fractures and concurrent osteoarthritis of the hip. Relative indications include old age, delayed presentation, substantial medical comorbidities, and pathologic obesity. Clinical outcomes with acute THR were similar to those with delayed THR. Although the results reported in the six studies reviewed here were satisfying overall, there is limited evidence in this area in the existing literature and future prospective investigations are required.
Conclusion: Data reported in the literature indicate that immediate THR can be successful in appropriately selected elderly patients or patients with extensive osteoporosis, combined acetabular and femoral neck fractures or pathological fractures. There is currently a limited evidence base for THR in patients with acetabular fractures; therefore, physicians' practice and expertise are the most useful tools in clinical practice.

Contents

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Introduction

The incidence of acetabular fractures is increasing, particularly in the elderly population [1,21,22]. Osteoporosis is a contributing factor in most hip fractures caused by low-energy falls; treatment of acetabular fractures in aged patients is challenging because of fracture patterns, poor bone quality, patient status and potential comorbidities [2].

Non-surgical management comprising prolonged rest represents a treatment option for minimally displaced fractures, or in patients who are unable to tolerate surgical treatment [3]. Non-operative treatment has proven to be unsuccessful in patients with displaced fractures because patients do not cope with prolonged bed rest with or without bone traction. In addition, these patients need quick mobilisation and early weight-bearing to enable a rapid and complete recovery [4].

Currently, ORIF is the treatment of choice for displaced acetabular fractures [4]. However, the outcome may often be compromised by osteoarthritis, femoral head necrosis or heterotopic ossification, even when anatomic reconstruction of the joint had been achieved [5–8]. For these reason many patients require salvage total hip replacement (THR) months or years after the initial trauma [9]. It has been reported that a belated arthroplasty following initial surgical treatment may be obstructed by heterotopic bone, scar tissue, muscles or acetabulum avascularity, impeding hardware or occult infection [10].

Acute THR has been proposed for the treatment of patients with acetabular fractures because it enables immediate full weight-bearing and reduces the occurrence of delayed surgery for post-traumatic onset of osteoarthritis [10,23]. This article is a systematic review of the literature on the use of acute THR for the treatment of acetabular fractures.

Materials and methods

Types of studies

This systematic review included studies published in English of subjects with acetabular fracture undergoing immediate THR. Date limits were set to between 1992 and 2012 to enable a review of recent data. Comparison groups were included (either control or alternative surgical intervention). Case reports, review articles and expert opinion or editorial pieces were excluded from the review.

Search strategy

Searches were conducted using the following databases: Pubmed/MEDLINE, CINAHL, SCOPUS, Embase and Ovid. The following keywords were used: 'acetabular fracture', AND 'surgical treatment' OR 'operative treatment', AND 'primary' OR 'acute', AND 'total hip replacement' OR 'total hip arthroplasty'. The abstracts of all hits were reviewed, duplicates were eliminated and references were hand screened for relevant citations.

Data extraction

Study characteristics, such as year of publication, study population, mean age, level of evidence, type of acetabular fracture, type of surgical technique and duration of follow-up, were extracted and collected by two reviewers, and checked by a third. An electronic database was created. The Oxford Centre for Evidence Based Medicine (CEBM) hierarchy of evidence was used to determine the level of evidence of studies [11].

Outcomes of interest included indications; clinical assessment, including walking ability; comparison with control group; associated procedures, and rate of complications, such as loosening or revision surgery.

Results

Search results

The database search retrieved 811 possible articles. Six studies met all the inclusion criteria for this review (Table 1). All were published between 2002 and 2010. The search resulted in only one level III comparative cohort study [12], and five studies were case-series (Level IV) [13–17]. One retrospective case series used a comparison group of patients treated with delayed THR [12]. One prospective case series was included [13]. One study that examined a cohort of patients treated with either acute THR or ORIF was excluded because it did not report the characteristics of the two populations separately [18]. Follow-up periods ranged from 29.4 months to 8.1 years in a long-term study. Table 1 provides an overview of the characteristics of the studies included in the review. Clinical outcomes, complications and failure rates are presented in detail in Table 2.

Indications

Most of the studies indicate that combined acute THR (alone or in combination with ORIF) is the treatment of choice in patients with complex fractures according to Letournel and Judet, concurrent osteoarthritis of the hip, associated femoral head fractures, pathological fractures, significant poor bone quality because of osteopaenia or osteoporosis, or non-reconstructable fractures [12,15,16,19]. Mears et al. [10,14] added the following criteria as indications for acute THR: marked impaction, extensive abrasion of the femoral head, marginal or central acetabulum impaction involving more than 30% of its surface area, and extensive acetabular comminution [14]. Relative indications included delayed presentation, substantial medical comorbidities, obesity, and advanced age [13].

Clinical assessment

Mouhsine et al. [13] examined prospectively 18 patients aged 65–93 years (mean age 76 years) who underwent associated THR and cable fixation. One patient died of unrelated disease. Clinical outcomes for the remaining patients were reported to be good to excellent. Mears and Velyvis [14] reported an average Harris Hip Score (HHS) of 89 (range 69–100); however, they reported less favourable results in patients aged 70–79 years (average HHS 87) and in those aged 80–89 years (average HHS 75), which represent the population that is more likely to receive this kind of treatment. Tidemark et al. [15] described 10 patients with a mean age of 73 years: HHS was good or excellent in six patients (60%) and

Table 1
Summary of studies included in the present paper reporting results of total hip replacement for acetabular fractures.

Author	Year	Level of evidence	Patient numbers	Mean age	Mean time from injury to surgery	Follow-up (range)	Type of acetabular fracture according to Letournel and Judet	Associated procedures
Sermon et al. [12]	2008	III Retrospective case–control study	64	78	N/a	30.7 months (12–180)	27 (42%) Elementary 37 (58%) Complex	None
Mouhsine et al. [13]	2004	IV Case series	18	76 (65–93)	10 days (3–16)	36 months (12–46)	2 (11%) Elementary 16 (89%) Complex	Additional cable fixation
Mears et al. [14]	2002	IV Case series	57	69 (26–89)	6 days (1–20)	8.1 years (2–12 years)	25 (44%) Elementary 32 (56%) Complex	Additional cable fixation, multiple screws, lag screws
Tidemark et al. [15]	2003	IV Case series	10	73 (57–87)	N/a	38 months (11–64)	5 (50%) Elementary 5 (50%) Complex	Burch-Schneider antiprotrusion cage
Herscovici et al. [16]	2010	IV Case series	22	75.3 (60–95)	5.1 days (3–22)	29.4 months (13–67)	22 (100%) Complex	Additional standard ORIF
Sarkar et al. [17]	2004	IV Case series	35	74 (41–91)	N/a	72 months (14–151)	14 (40%) Elementary 21 (60%) Complex	Additional standard ORIF (23), reinforcement ring (15), metal mesh (3)

ORIF: Open reduction internal fixation. N/a: Not available.

health-related quality of life according to the EQ-5D was 0.62, compared with 0.78 in an equally matched reference population. The average HHS reported by Herscovici et al. [16] was 74 in a population with a mean age of 75.3 years; all patients had complex fractures according to Letournel and Judet and were treated with combined ORIF and THR.

Walking ability

Tidemark et al. [15] reported the use of walking aids in patients aged from 57–87 years who underwent primary THR with a Burch-Schneider antiprotrusion cage and autologous bone grafting. All patients were independent walkers at follow-up with only 30% of patients requiring a walking aid. In the study by Mears and Velyvis [14], 68% of patients walked normally or with a slight limp and without a support; 23% could walk for long distances with a cane and 9% were not able to walk even with support. In the study by Herscovici et al. [16], seven patients deambulated without any aids, five required a cane, five used a walker (two of them required an abduction brace) and one used a wheelchair. In the study by Sarkar et al. [17], four patients were severely impaired, relying permanently on crutches, whereas four patients were able to go mountain hiking, play tennis or work as a farmer or truck driver on a construction site.

Associated procedures

Prosthesis alone was used for the management of acetabular fractures in one of the studies in this review [12]. In two studies, fractures were treated with an associated cable fixation [13,14]. In one paper, THR was associated with the use of a Burch-Schneider antiprotrusion cage together with bone grafting [15]. Herscovici et al. [16] used standard ORIF as they claimed that cable fixation may not manage column injuries or acetabular fractures in patients with significant osteopaenia. Sarkar et al. [17] used different techniques for acetabular reconstruction through the years, from conventional screws and plates to roof reinforcement with antiprotrusion cages. The authors did not report any differences in stability or complication rates between the results of the earlier cemented cups and the use of reinforcement rings in later years.

Comparison with control group

Sermon et al. [12] compared the results of primary THR in patients with an average age of 78 years with those of delayed THR in patients with an average age of 53 years. A reduced revision rate (8% compared with 22%) and a reduced occurrence of heterotopic ossification (28% compared with 41%) were observed in the acute THR group compared with the delayed THR group. However, there were more patients with subjectively excellent or good results according to the HHS in the delayed THR group compared with in the primary THR group (76% compared with 58%). None of these differences were statistically significant.

Complication and failure rates

Overall, the following major complications were reported: four deep vein thromboses [14,15] and one transient ischaemic attack [16]. Average HHS when reported ranged from 74 to 89. Wound complications, which included either superficial wound infections or wound healing problems, were reported in two patients [16,17]. Presence of heterotopic ossification was the most recurrent complication in the studies considered, and ranged from 10% to 40%. The dislocation rate ranged from 0% to 14%. One study reported complications arising from hardware intolerance,

Table 2
Clinical outcomes, complications and failure rates.

Author	Harris Hip score	Complications	Loosening rate	Dislocation rate	Revision rate	Notes
Sermon et al. [12]	21 Excellent 10 Good 15 Fair 7 Bad	18 (28%) Heterotopic ossifications	N/a	0 (0%)	4 (8%)	Reduced revision rate and reduced occurrence of heterotopic ossification in the acute THR group
Mouhsine et al. [13]	N/a	2 (11%) urinary tract infections* 6 (35%) heterotopic ossifications*	0 (0%)	1 (6%)*	0 (0%)	100% clinically excellent and good result
Mears et al. [14]	89 (range 69–100) 33 (58%) Excellent 12 (21%) Good 9 (16%) Fair 3 (5%) Bad	3 (5%) deep venous thrombosis 1 (2%) intolerance to hardware 6 (10%) heterotopic ossifications	0 (0%)	2 (4%)	3 (5%) 1 dislocation 1 hardware removal 1 heterotopic ossification removal	45 (79%) good/excellent Harris Hip Score
Tidemark et al. [15]	85 (range 69–99) 2 (20%) Excellent 4 (40%) Good 3 (30%) Fair 1 (10%) Bad	4 (40%) heterotopic ossifications 1 (10%) deep venous thrombosis	0 (0%)	1 (10%)	0 (0%)	All patients were independent walkers at follow-up with a need for walking aids in 30% of cases
Herscovici et al. [16]	74 (range 42–86)	2 (9%) urinary tract infections 1 (4%) transient ischaemic attack 4 (18%) heterotopic ossifications 1 (4%) wound deiscence	2 (9%)	3 (14%)	5 (23%) 2 dislocation 2 loosening 1 heterotopic ossification removal	Better results in 19 patients treated using a Kocher-Langenbeck approach compared to ilio-inguinal
Sarkar et al. [17]	N/a	2 (10%) recurrent dislocation** 2 (10%) deep infection** 1 (5%) superficial infection** 3 (16%) cup loosening** 1 (5%) stem loosening** 1 (5%) fracture of the ceramic head**	4 (21%)**	2 (10%)**	8 (42%)** 2 dislocation 3 loosening 1 deep infection 1 superficial infection 1 fracture of the ceramic head	Low overall outcomes due to patients' general situation which was frequently compromised by preexisting chronic diseases or by sequelae of concomitant injuries

N/a: Not available.
* Results refer to 17 patients.
** Results refer to 19 patients.

requiring revision [14]. The highest revision rate (42%) together with the highest prevalence of radiographic loosening (21%) was reported by Sarkar et al. [17]. Herscovici et al. [16] reported the highest rate of dislocations (14%) (Table 2).

Discussion

The most important finding of the present study is that acute primary THR can be successful in appropriately selected elderly patients, according to data reported in the literature. Selection criteria must be strict to maximise the outcome. Common indications include poor bone quality, combined acetabular and femoral neck fractures or pathological fractures and concurrent osteoarthritis of the hip. Relative indications include old age, delayed presentation, substantial medical comorbidities, and pathologic obesity.

Among the papers considered in the present review, the preferred surgical technique was the association of THR and cable fixation [13,14]. Only one study used prosthesis alone [12]. In one study, THR was associated with the use of a reinforcement ring together with bone grafting [15] and in one paper standard ORIF was employed [16]. One study that considered the outcomes of acetabular reconstruction through several years used either conventional screws and plates or roof reinforcement with antiprotrusion cages [17].

Acute THR was associated with satisfying outcomes with regard to clinical assessment and walking ability, with an average HHS ranging from 74 to 89. In the comparative study that assessed the difference in outcomes between acute THR and delayed THR in acetabular fractures, improved outcomes were observed in the delayed THR group although the differences were not statistically significant [12]. Advanced age is a poor prognostic factor for functional outcome. Mears and Velyvis reported lower HHS in elderly patients compared with younger patients in a patient population ranging in age from 26 to 89 years [14]. The most frequent complications encountered were heterotopic ossifications and dislocations.

Dislocations are a major problem during THR surgery, particularly in patients with cognitive impairment [20]; therefore, this type of treatment may not be optimal in patients with severe cognitive dysfunction. The use of THR for acute acetabular fracture in patients with neurologic impairment is also debated. Sarkar et al. recommended THR in patients suffering from somatosensory, neurologic or psychiatric diseases [7]. These authors indicated that the reduced ability of the patients to participate in rehabilitation after reconstructive surgery may affect the outcomes of treatment with ORIF.

A disadvantage of the use of THR in acute treatment of acetabular fractures is the difficulty of achieving effective stability of the acetabular fracture to minimise the risk of aseptic cup loosening [14]. According to some authors, the use of cable fixation [13,14] or plates and screws [16] is required to achieve sufficient stability of the implant.

Tidemark et al. [15] advocated the use of a reinforcement ring. Sarkar et al. [17] observed that reinforcement rings appeared to provide higher initial stability compared with conventional screws and plates for acetabular reconstruction; however, there were no differences in stability or complication rates between the two techniques. In the comparative study, a reduced revision rate was observed in the acute THR group compared with the delayed THR group (8% compared with 22%) [12].

The highest radiographic loosening rate (21%) was reported by Sarkar et al. [17]: the overall clinical condition of the patients in this report was frequently compromised by preexisting chronic diseases or by sequelae of concomitant injuries. Herscovici et al. [16] reported the highest dislocation rate (14%) in a population of elderly patients with complex fractures. The authors concluded that acute THR may not manage column injuries or acetabular fractures in patients with significant osteopaenia.

In summary, ORIF is widely considered to be the standard treatment for young and middle-aged patients with an acetabular fracture; however, primary THR could be a more suitable approach in elderly patients with concomitant chronic systemic diseases or local disorders that may prevent anatomic reconstruction of a functioning hip joint. Indications for primary THR include bone quality, concomitant femoral neck fractures or pathological fractures and concurrent osteoarthritis of the hip. Advanced age, delayed presentation, substantial medical comorbidities, and pathologic obesity are relative indications. Problems related to the combined ORIF and THR procedure included high transfusion rates, lengthy anaesthetic times, and technical difficulties [16]. THR is a severe intervention that can lead to major complications and may be challenging even in experienced hands.

The main limit of this systematic review is the considerable lack of high level studies supporting primary THR for acetabular fractures. Only one study provided a subgroup analysis to compare outcomes in patients with immediate THR and delayed arthroplasty for failed primary non-operative or operative treatment. Further randomised trials and comparative studies are required to enable surgeons to determine the correct therapeutic approach for patients with fracture of the acetabulum. There is currently a limited evidence base for THR in patients with acetabular fractures; therefore, physicians' practice and expertise are the most useful tools in clinical practice.

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