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Does timing of surgery matter in fragility hip fractures?

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Abstract The effect of delay of surgery on the geriatric hip fractures has been a subject of interest in the past two decades. While the elderly patients will not tolerate long periods of immobilization, it is still unclear how soon these surgeries need to be performed. A review of existing literature was performed to examine the effect of timing of surgery on the different outcome parameters of these patients. Although there is conflicting evidence that early surgery would improve mortality, there is widespread evidence in the literature that other outcomes including morbidity, the incidence of pressure sores, and the length of hospital stay could be improved by shortening the waiting time of hip fracture surgery. We concluded that it is beneficial to the elderly patients to receive surgical treatment as an urgent procedure as soon as the body meets the basic anesthetic requirements.

Keywords Complication · Hip fracture · Mortality · Outcome · Timing of surgery

Introduction

Fragility hip fracture is a major cause of mortality and morbidity in the elderly. The primary goal of treatment for these fractures is to achieve stable and painless lower

extremity as soon as possible. The optimal treatment for these injuries is surgery since non-operative treatment was associated with longer hospitalization, more mal-unions, and less likely to return to an independent level of functioning [1]. It is then logical to perform early surgery for medically stable patients since prolonged immobilization is likely to increase the chance of pulmonary and urinary complications. However, for patients with significant co-morbidities, a longer period of pre-operative evaluation and optimization will be required.

The effect of timing of surgery on patients undergoing hip fracture surgery has been a subject of interest in the past two decades. The evidences examining the timing and outcome in hip fracture surgery have been largely prospective or retrospective cohort studies. This is due to the fact that the design of randomized controlled trials regarding surgical timing has low feasibility and is unlikely to obtain ethical approval.

Patients with hip fractures are often a heterogeneous group with different co-morbidities, and the individual treatment is affected by variable confounding factors and different treatment protocols. Hence, it is not always possible to draw definite conclusions. Albeit the conflicting opinions currently available, it is important for all health care workers involved to examine existing evidences of the effect of delay on outcomes to determine the best care for these patients. It is the purpose of this review article to highlight the knowledge acquired from current literature regarding the effect of delay on patients undergoing hip fracture surgery.

Materials and methods

We performed a literature review of publications that studied the effect of delay of surgery on hip fracture

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patients. PubMed was searched for medical literature published in peer-reviewed journals from 1980 to April 2010. We only included articles which provided definitions and treatment recommendations for delay in hip fracture surgery. Non-English literature was excluded. A total of 42 articles, published from June 1984 to July 2009, were identified. The following key words were used: “timing of surgery”, “surgical delay”, “hip fracture”, and various combinations of these phrases. We specifically studied four main outcome measures in these articles, which were mortality, morbidities including pulmonary and infectious complications, pressure sore incidence, and the length of hospital stay.

Results

Effect of delay to surgery on mortality

The true mortality as a result of the hip fracture or complications from related treatment is unknown, since it is often impossible to determine the extent of contribution from hip fracture to the eventual death. For the purpose of this study, mortality is regarded as short-term if it occurs within 30 days post-operatively and long-term if it occurs within 1 year post-operatively.

Short-term mortality

There are a number of reports in the literature suggesting the beneficial effect of early surgery on improving short-term mortality, although the definition of early surgery varies [2–9]. Dorotka et al. found surgery within 6 h safe and patients had lower mortality [5]. Hoerer et al. reported their results of 494 patients operated within 24 h [6]. The overall immediate post-operative mortality was only 1.6%, which provided a good support for early surgery. Bottle et al. conducted an analysis of hospital statistics involving 129,522 admissions and showed that a delay in hip fracture operation of more than 24 h was associated with higher risk of mortality [7]. McGuire et al. examined 18,209 patients with hip fracture surgery done and found increased mortality within 30 days in patients with delay of surgery for two or more days [8]. Another recent study on 5,683 male veterans with hip fracture also showed a delay of 4 days or more was associated with higher mortality [9].

Evidence also exists to suggest that early surgery does not affect short-term mortality rates [10–14]. Majumdar et al. reported no independent association between timing of surgery and short-term mortality [11]. However, they divided the data into ‘within 24 h’ and ‘24–48 h’. The latter group was regarded as early surgery in other studies. Based on their results, they suggested that using ‘surgery

within 24 h’ as an indicator of high-quality care might not be suitable, as it would not affect short-term mortality. Sund and Liski collected observational data from 16,881 first time hip fracture patients and found the effect of surgical delay on mortality quite small [12]. Nevertheless, they still suggested that late surgery was associated with non-optimal treatment. A recent study by Lefaivre et al. also did not demonstrate delay to surgery as a significant predictor of short-term mortality [13]. In the univariate analysis from the Scottish hip fracture audit which collected information prospectively relating to 18,817 patients, no significant relationship was found between time from admission to surgery and early post-operative mortality [14]. Only two studies by Kenzora et al. [15] and Mullen and Mullen [16] actually demonstrated an increased short-term mortality in patients with hip fracture surgery done within 2 and 3 days, respectively.

Long-term mortality

The effect of surgery delay on long-term mortality is more difficult to prove as this group of elderly patients with deteriorating physical and mental state has already high mortality rate. To show a causal relationship would not be easily achievable as the causes of mortality are often medical diseases related. Nevertheless, Novack et al. showed the length of surgery delay had a gradual effect on increasing mortality of both short-term and long-term [17]. Similar findings were also reported from Casaletto and Gatt [18], Zuckerman et al. [19], and Elliott et al. [20]. Gdalevich et al. [21] reported their results of 651 patients and found early surgery within 48 h was associated with improved 1-year mortality. Since the pre-morbid status and pre-existing co-morbidities of the patients will also affect mortality, there have been attempts to classify patients as ‘fit for surgery’ and ‘with medical co-morbidities’. Although the categorization is somewhat arbitrary, it is still useful to readers in the interpretation of these publications so that a fair comparison can be made. Hamlet et al. found that lower mortality in patients operated within 24 h, regardless of their pre-operative American Society of Anesthetists (ASA) classification status [22]. Moran et al. found that up to 4 days of delay did not have any effect on patients who were otherwise fit for surgery [23]. However, a delay of hip fracture surgery of more than 4 days was associated with significantly increased mortality at 90 days and 1 year.

Again, conflicting evidences existed with regard to long-term mortality [24–29]. Verbeek et al. found that a delay of hip fracture surgery was not associated with increased 1-year mortality, based on univariate regression method [25]. Williams and Jester also found no relationship between a delay of surgery and 1-year mortality when all

other independent variables were controlled [26]. Stoddart et al. showed a 1-year mortality rate of 17.4%, but time to surgery did not affect this 1-year mortality significantly [27]. Orosz et al. reported the result from four hospitals in New York and used 24 h as the dividing line. Early surgery was not associated with improved mortality and function [28]. McLeod et al. also found no association between early surgery and improved mortality rate [29]. Instead they suggested that patient-related factors such as age, gender, and health status were more important than process-related factors such as delay to surgery, type of surgery, and type of anesthesia in the long-term survival of these patients.

On the whole, the evidences in the literature regarding the effect of delay to surgery on mortality are conflicting and there is no conclusive evidence on which a recommendation can be based.

Morbidity

An important goal of treatment of fragility hip fractures is the avoidance of complications. In particular, complications occurring in the post-operative period can negate any gains made by successful surgery. The most commonly investigated infective complications related to hip fractures are chest infection and urinary tract infection. It is postulated that early surgery for hip fractures should decrease these infective conditions as these problems are commonly due to inadvertent immobilization of the patients. After fracture of the hip, these patients were unable to move not just the hip because of the pain but also unable to cough and void properly because of the severe hip pain. And many of them actually have subclinical chest or urinary tract infective state even before the fracture, the hospitalization and immobilization after the hip fracture triggers the vicious cycle.

On the whole, there are good evidences in the literature to support that early surgery would minimize the risk of morbidities in these patients [13, 30, 31]. Most investigators regarded infectious complications and pneumonic conditions as significant. An autopsy study performed in 581 patients with hip fractures found that the causes of death were correlated with timing of surgery and that surgical intervention within 24 h of injury significantly reduced death from bronchopneumonia and pulmonary embolism [31]. Lefaivre et al. found that a delay of more than 24 h was a significant predictor of a minor medical complication and a delay of more than 48 h was also predictive of a major medical complication such as chest infection [13].

Some surgeons argued that the post-operative infective complications should not be analyzed based on the whole heterogenous hip fracture group because the likelihood of developing these problems is dependent on the premorbid

conditions of the patients. Verbeek et al. [25] found that the ASA I and II patients had less post-operative infective complications when operated less than 24 h. In another study, Rogers et al. classified the hip fracture patients by the Acute Physiology and Chronic Health Evaluation II score and the number of co-morbidities [4]. They found that the physiologically stable patients had much higher infective morbidities when operated more than 72 h after admission. Orosz et al. identified those medically stable patients, when they were operated less than 24 h, the chance of having major complications, which include pneumonia, is significantly less [28].

However, Hoening et al. did not find a statistically significant increase in medical complications in patients who had earlier surgical repair [32]. In another study, Grimes et al. retrospectively compared the hip fractures operated less than 24 h to those operated more than 24 h and concluded that there was no relationship between timing of surgery and serious bacterial infection [33].

Pressure sores

The occurrence of pressure sore is a result of the damage of prolonged skin constantly under shear pressure due to prolonged immobilization. Therefore, the earlier the patient is mobilized, the lesser the chance of getting pressure sore. Several authors have investigated whether the incidence of pressure sores would be increased with a delay of hip fracture surgery.

Published reports generally supported the above theory [13, 33–35]. Lefaivre et al. showed that when the surgery was delayed for more than 24 h, it was significantly related to increase in pressure sore [13]. Grimes et al. showed that the risk of decubitus ulcer increased as the surgery was delayed for more than 96 h [33]. Al-Ani et al. further proved that the incidence of pressure sore was not only related to delay in surgery, but the odds ratio increased progressively as the delay increased from 24 to 36 to 48 h [35]. We could not identify any study showing that the development of pressure ulcer is not related to prolonged pre-operative waiting time.

Length of stay

Another important reason why many trials were conducted to investigate the impact of timing of surgery is that it has significant financial implication on the health care system [36, 37]. One of the important indicators of the resources needed is the number of days in hospital or length of stay. Most of the evidence nowadays tends to agree that shortening the pre-operative waiting time would shorten the hospital stay in post-operative as well as the total period.

Lefavre et al. studied all the hip fracture patients admitted to the hospital from 1998 to 2001 [13]. They showed that delay in surgery was significantly related to increased time to discharge in acute hospital. Verbeek et al. studied the effect of delaying surgery for more than 1 day [25]. Although there was no significant relationship, there was a trend of fewer complications and shorter hospital stay when patient was operated less than 1 day ($p=0.088$). Thomas et al. conducted a specific investigation of the relationship between pre-operative wait and post-operative stay [38]. The finding was that when the pre-operative hospital stay was increased by two times, the post-operative hospital stay was increased by 19% ($p=0.01$). Doruk et al. found a positive relationship between pre-operative waiting time of more than 5 days and increased total hospitalization time [39].

It is common for investigators to adopt 48 h of admission as the dividing line. Siegmeth et al. found that if patients were operated on after 48 h of admission, the post-operative hospital stay was prolonged by 10.9 days [40]. Similar findings were reported by Hoenig et al. and Bergeron et al. [32, 41].

Still this was not universally supported by all studies. Harries and Eastwood specifically looked into post-operative length of stay and could not identify any relationship with surgeries done within 24 h [42]. Ho et al. also revealed the waiting time for surgery was not a significant predictor of post-surgery length of stay when confounding factors were controlled [43]. Hamilton et al. also identified a similar result [37].

Although there were some contradictory evidences on the above problem, the overall evidence favored that the shorter the pre-operative waiting time, the shorter will be the overall length of stay.

Other outcomes measured

Early surgery also reduced the duration of pain and dependency of these patients. Orosz et al. found that earlier surgery was associated with fewer days of severe and very severe pain, although post-operative pain did not differ [28].

Other studies examined the effect of surgical delay on longer-term outcomes. Villar et al. showed that patients who had an operative delay (median of 57 h) had a worse rehabilitation than those who had early surgery (median of 29 h) [44]. Al-Ani et al. found that patients who had operation more than 36 and 48 h after admission were less likely to return to independent living within 4 months [35]. Late operation (5 days after hospitalization) was found to be associated with an increased time of recovery of weight-bearing ability and a worse activity of daily living score [39].

Discussion

Although a plethora of information exists documenting the influence of timing of hip fracture surgery on outcomes, it remains a conundrum as to which patients would benefit from delay and further medical evaluations. This lack of conclusion is surprising considering the clinical importance of fragility hip fractures and the increasing number of older patients suffering from fractures. Creating effective treatment models will have a profound impact on the health care systems in many parts of the world.

Our review revealed prevalence in existing literature that could show the benefits of early surgery on morbidities and complications, pressure sore incidence, and the length of stay of hip fracture patients. However, the evidences regarding short-term and long-term mortality are more conflicting. In another recent review of 52 published studies involving 291,413 patients, the authors also found that none of the studies demonstrated a causal relationship between operative delay and mortality [45]. Although powerful in terms of number, these analyses failed to address the cause of the operative delay and could not demonstrate whether the cause of death was due to the delay or pre-existing co-morbidities.

From our study, we found that the conclusion or recommendation made by the authors may depend on the type of journal published. There were 23 out of a total of 34 reports advocating or suggesting early surgery that were published in orthopedic or surgical journals. All of these conclusions were based on medical reasons. The other 11 reports published in non-orthopedic journals advocating early surgery were based on medical and economic reasons. On the other hand, seven of the 11 reports suggesting that early surgery had no benefits or even bad influence on outcomes were published in non-orthopedic journals. This may reflect the zealous efforts of orthopedic researchers in looking for evidence to support the case of early surgery. As a result of these evidences, there is more awareness of the situation and health care providers of specialties other than orthopedics start to pay greater attention to the growing problem. More recently, a systematic review and meta-analysis of 16 observational studies published in an anesthesiology journal found that operative delays of more than 48 h were associated with an increased risk of 30-day and 1-year mortality [46].

Orthopedic surgeons should work hand in hand with other disciplines in the management of these patients. In general, it would be helpful to categorize patients into stable, stable with one or more co-morbidities, and unstable groups. While it is possible to perform early surgery for stable patients, surgery should be performed in patients with complex co-morbidities once they are optimized. On the other hand, the condition of unstable patients should be better optimized before surgery is contemplated. It requires

a common understanding of the different disciplines of health care personnel to work towards this goal.

Protocols and guidelines would help doctors and the patients in the decision-making process as when surgery can be safely done. The Scottish Intercollegiate Guidelines Network suggest that medically fit patients should receive surgery as soon as possible, within safe operating hours, after presenting to hospital [47]. The British Orthopedic Association guidelines also state that surgical fixation should not be delayed for more than 48 h from admission unless there are clearly reversible medical conditions [48]. The Royal College of Physicians recommends that for patients with hip fracture operations should be carried out within 24 h, by senior staff [49]. As a result, some hospitals, governments, and administrators have set this as a target, making hip fracture as a performance indicator in the quality of healthcare delivery.

Conclusion

Although there is no solid evidence that early surgery would improve mortality, there is widespread evidence in the literature that other outcomes including morbidity, the incidence of pressure sores, and the length of hospital stay could be improved by shortening the waiting time of hip fracture surgery. Early surgery can also bring better pain relief. Hence, it is still advisable for surgeons to treat these patients as soon as their bodies meet the basic anesthetic requirements. This timing may vary from individual patient and would not be identical. Disagreement exists even among doctors from different medical specialties. However, setting a goal of surgery within 24 h by hospital and administration would greatly help to bring together the team to provide a timely and effective treatment to these patients.

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Conflicts of interest Dr. Leung is the speaker for Synthes and has received research support from Synthes. The other authors declare no conflicts of interest.

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