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The Final Thesis

Hip Replacement in Intertrochanteric Femur Fractures

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Inhaltsverzeichnis

SUMMARY

Intertrochanteric fractures are one of the most common fractures of the elderly. With an aging population the incidence is projected to double by the year 2050. The treatment of that fracture type is up to debate with respect to well-known complications of the current treatment. Due to demographic changes the patient group of patients at risk for developing these complication different voices have proposed the use of hemiarthroplasty as primary treatment modality. The role of total arthroplasty remains small and reserved for a small patient population.

Different studies have worked on this topic over the last years and found heterogenous results. Some of the papers describe primary hemiarthroplasty as a valuable alternative in the treatment of intertrochanteric fractures, while others are warning that this treatment modality might put the patients' health at risk. What becomes clear throughout the studies is the early weight-bearing opportunity of hemiarthroplasty is an aspect that might improve the early outcome of patients, that are at high risk of a loss of independence due to loss of physical capabilities.

The comparability and significance of the different studies is complicated by different treatment modalities that are compared within the studies and the large scale of sample size in the studies.

To improve the treatment and the outcome of patients with intertrochanteric fractures and evaluate the possible usage of hemiarthroplasty in these fractures, more and larger scale scientific work is needed. Especially the identification of patient subgroups that would benefit and those that would be harmed using hemiarthroplasty is needed.

KEY WORDS

Intertrochanteric fractures, Hemiarthroplasty, Arthroplasty, Dynamic Hip Screw, Proximal Femoral Nail Antirotation

INTRODUCTION

Intertrochanteric fractures are a common fracture of the proximal hip. It accounts for about 50% of all hip fractures (1). It is commonly seen in elderly patients following ground-level falls. With a population continuously ageing studies predict a rise in the occurrence of hip fractures and as well intertrochanteric femur fractures. Cooper et al expect a rise to 4.5 million hip fractures per annum by 2050 (2). Other studies suggest that by the same time the incidence of hip fractures will double in western industrial countries (3).

The burden of Intertrochanteric fractures is estimated to be approximately six billion dollars per year in the US alone (4). The costs high not only depend on the treatment of the fractures but also on other associated costs. A major role plays costs for the management of other health complications following the fracture as well as nursing costs.

Hip fractures are strongly connected with high mortality and morbidity and are a potential landmark in one's health history (5).

The mortality of intertrochanteric fractures is higher compared to the mortality of femoral neck fractures (6). While the treatment of femoral neck fractures is widely agreed on, there is discussion on the treatment of intertrochanteric fractures.

The treatment of intertrochanteric fractures includes closed reduction with intramedullary fixation with intramedullary nails as well as open reduction and internal fixation using sliding hip compression screw or proximal femoral locking plate.

Especially concentrating on the elderly patient group, studies report postoperative complications of the osteosynthesis like cut-out or non-union (7). Following complications of primary osteosynthesis Hemiarthroplasty is often used for treatment. Based on high failure rates of osteosynthesis of up to 16.5% (8) in patients suffering from osteoporosis and with other co-morbidities, some authors suggest the use of Hemiarthroplasty in patients with high risk of osteosynthesis failure.

LITERATURE SELECTION STRAREGY

The literature selection and search is done using the platform Pubmed. The search words included (pertrochanteric) or (intertrochanteric) and (fractures) and (treatment) and (hemiarthroplasty), resulting in 83 results. Included into the work are only studies available with the full text and in English. In the end only 27 results were included, as several studies did not work on the topic of interest, were not available in English or at all.

CLINICAL DESCRIPTION

ANATOMY

The hip joint (Art, coxae) is formed by the femoral head (Caput femoris) and facies lunata of the acetabulum. The spherical caput femoris sits in the hollow sphere of the acetabulum an allows a wide range of motion in the hip joint. The femoral head is connected to the femoral shaft via the femoral neck (Collum femoris). The neck-shaft angle formed by the femoral shaft

is approximately 127° (9). Additionally, the neck itself is rotated laterally forming an anteversion of 10-15°. In the proximal part of the femoral shaft two apophysis impose, the greater trochanter (Trochanter major) and the lesser trochanter (Trochanter minor).

In between both trochanters are ventral the linea intertrochanterica as well as the crista intertrochanterica on the dorsal side. These define the border between the collum femoris and the intertrochanteric part of the femur. This devides the proximal hip into intracapsular at the proximal side and into extracapsular at the distal part. At the basis of the trochanter major is mediocranial the fossa intertrochanterica.

The femoral head is stabilized in its position by the three ligaments: lig. pubofemorale, lig. iliofemorale and lig. ischiofemorale.

There are five muscels attached to the trochanter major. These muscles are m. gluteus medius, m. gluteus minimus, m. piriformis, m. obturator externus, and m. obturator internus.

The two muscles inserted to the trochanter minor are m. psoas major and m. iliacus.

The blood supply of the proximal femur is provided by branches of the femoral artery including medial and lateral circumflex femoral arteries and branches of the superior and inferior gluteal arteries.

The compression forces acting on the caput femoris reflect in strong compressive trabeculae from the femoral head´s cranial surface to the femoral shaft´s compacta. Those trabeculae continue to the weightbearing corpus ossis ilii, projecting to the corticalis of the acetabular roof. In Combination with tensile trabeculae, it forms a ward triangle of low trabecular density represented in radiological imaging.

Intertrochanteric fractures are defined as extracapsular fractures of the proximal femur. The fracture occurs at the level of the trochanter major and the trochanter minor.

CLASSIFICATION

Different attempts to classify intertrochanteric fractures have been made. Those systems take different rationales into account. Most used systems are the AO/OTA and Evans-Jensen´s classifications. Others are the Kyle´s classification, Boys and Griffin classification, Tronzo´s classification, Decoulx and Lavarde´s Classification, the Briot Classification Diaphyseo-Trochanteric fractures, Dr. G.S. Kulkarni et al Classification, the Eder Classification.

Generally intertrochanteric fractures can be classified into stable and unstable fractures. Stable fractures are marked by its intact posteromedial cortex and can withstand medial compression

once reduced. Unstable fractures on the other hand usually collapse into varus or displace medially.

The AO foundation defines intertrochanteric fractures as a passing of the fracture line between the two trochanters. Usually both cortices of the femur are involved. It is classified as AO/OTA 31A3. The further subdivision is made into simple oblique fracture (31A3.1), simple transverse fracture (31A3.2) and wedge or multifragmentary fracture (31A3.3). The wedge fracture type is the most seen type.

The Evans classification is a 1949 published system. It is based on the stability of the fracture after closed reduction and skeletal traction. For Evans the continuation of the posterolateral cortex continuation is important for the stability of the fracture. With his classification for better understanding of intertrochanteric fractures. The division is made into Type I and Type II. Type I is further subdivided into stable undisplaced fracture, stable displaced, but after reduction an overlap of medial cortex forming a stable fracture, unstable displaced and medial cortex is not restored after reduction, unstable displaced and comminute fracture without restoration of the medial cortex after reduction. Type II are reverse obliquity fractures.

In 1975 Jensen modified the Evans classification by adding Type III fractures. With that the amount of fracture types got reduced to five by including rarer fractures into other types and put more emphasis on better prediction of the outcome after treatment.

On the other hand, the Kyle´s classification adds a new type of fracture with extension into the femoral neck. Other fracture types are like the Evans classification.

Boyed and Griffin were the first to take instability not only in coronal but also the sagittal plane into account. They also consider fractures up to 5 cm below the trochanter minor as intertrochanteric fractures. The classification predicts the difficulty of fracture reduction.

Tronzo´s Classification is based on Boyed and Griffin. It takes the two-plane instability as well as biomechanical factors into account.

Decloux and Lavarde´s classification has descriptive character and only classifies the fracture by the location of the fracture line.

The Briot Classification Diaphyseo-Trochanteric Fractures from 1980 takes previous classifications like Evans´ or Boyds´ into account. It puts more emphasis on the posterior wall as predictor for stability.

The Eder Classification describes the mechanism of injury and hints how to reduce the fracture during surgery.

Dr. G.S. Kulkarrni et al Classification or Modified Jenson- Evan´s Classification combines the AO and the Evan-Jensen Classifications. It focuses on possible treatment modalities for the different fracture types.

For the classification of intertrochanteric fractures various systems have been developed. Those take different fracture modalities into account. Some have proved to be reliable and reproductible in clinical practice and to support clinical research.

INCIDENCE AND TRENDS

Intertrochanteric fractures play a major role in fracture treatment of orthopaedic practice. It accounts for 45% of all hip fractures and for 3.6% of all extremity fractures (10–12) .About 280,000 fractures of this type are recorded in the US per annum (13). Worldwide it is expected that the incidence of intertrochanteric fractures will double to 4.5 million cases per year (14). The incidence of intertrochanteric fractures is strongly associated with the age of a certain population. Studies found that the highest rates of hip fractures are found in Scandinavia, while the lowest rates are found in Africa. Especially in industrialised countries the incidence is high. In Asia the rates are variable. In Iran relatively high rates are observed, while in other countries like mainland China the rates are comparable to those in Africa (15).

With respect to global warming studies searching for seasonality trends in the incidence of hip fractures found that the highest rates of hip fractures were found in the cold months of autumn and winter, while the warmer months have a negative association to hip fracture rates (16). Other trends in hip fracture might include the western lifestyle. Studies investigated the trends of hip fractures in eastern and western Germany after the unification. In a period of 25 years from 1971 to 1996 the amount of hip fractures doubled, while in Western Germany the rates rose less significantly. The trends are believed have multifactorial reasons, but the evidence suggests the significant influence of Western lifestyle (17).

In Germany in 2019 over all intertrochanteric fractures were in second place for fractures requiring hospital treatment (18).

DISEASE MECHANISM

Fractures of the proximal femur are often scientifically reviewed taking all different types of fractures into account. This includes intracapsular as well as extracapsular fractures. This is due to the similarity of the epidemiology.

The disease mechanism of proximal femur fractures usually includes low energy ground level falls. In studies examining fall-related fractures showing the second highest prevalence for hip

fractures in all age groups. In a population aged 59 years or older fractures of the proximal femur even have the highest percentage (19). An important role in the mechanism of fractures of the proximal femur plays osteoporosis. At least half of the hip fractures occurring in patients older than 79 years is related to osteoporosis (20–23).

Osteoporosis is a disease of the bone marked by decreased density and deterioration. Due to the loss of bone resilience the risk of fragility fractures is increased (24). This leads to fractures occurring in traumas that in healthy persons would not result in fractures. In the US about a quarter of the adult population either suffers from osteoporosis or decreased bone mass (25).

TREATMENT METHODS

IMPLANTS

For the treatment of intertrochanteric fractures different treatment modalities are available. Conservative treatment is rarely chosen as treatment, but it has a role in highly specific patient groups.

Operative treatment is the first-choice treatment for intertrochanteric fractures. There are different devices available and usually used. The devices can be divided into intramedullary implants and extramedullary implants. The Sliding hip screw is one of the most used implants and is an extramedullary implant. Different intramedullary nailing systems with InterTan nail, gamma nail and proximal femoral nail antirotation.

First, the sliding hip screw is commonly used as treatment for fractures of the proximal femur. It consists of a side plate with a barrel, a lag screw, and a compression screw. The side plate´s barrel is is angled. The side plate is fixed to the lateral side of the proximal femur using cortical screws. The lag screw is inserted through the barrel of the side plate and passed into the femoral head. The compression screw holds the lag screw in place.

The screws are not fixed to the side blade and allow dynamic compression of the fracture fragments. That allows for better healing.

On the other side different intramedullary nailing systems are available.

The Gamma nail system is as well one of the most used systems for the surgical treatment of intertrochanteric femur fractures. It consists of an intramedullary nail, that is available in different lengths and widths. A lag screw is inserted in angles of 120°, 125° or 130° through the nail into the femoral neck and head. The lag screw is held by and set screw, that is inserted from the proximal side of the nail. It prohibits the lag screw from rotation but allows lateral movement only. This leads to compression on the fracture. The nail is distally locked using

locking screws, allowing statically, secondary dynamization or dynamic locking, depending on the position of the distal locking screws. The gamma nail allows for immediate weight-bearing. The proximal femoral nail antirotation (PFNA) is a system, that is like the gamma nail, as the design of the gamma nail is modified.

consists of an intramedullary nail with an angulation of 6° and is available in different lengths. The width is smaller compared to the gamma nail. On the proximal end of the nail a blade can be inserted into the femoral head. Angels of 125°, 130° and 135° are possible. The blade replaced the former dual femoral head-neck screw system. The blade is locked using an internal screw, prohibiting movement and rotation of the blade. By that controlled compression of the fracture is allowed. The PFNA allows for immediate weight-bearing (26).

The Intertan Nail is a similar system. It was designed to reduce the risk of complications associated with other systems. It also allows for controlled compression at the fracture site. Additionally, it is said, that is prevents cut-out of the implant as well as decreasing the risk of distal femur fractures and provides higher level of stability (27).

COMPLICATIONS

Both different implant types have certain advantages and disadvantages. From a biomechanically viewpoint intramedullary implants have an advantage over extramedullary implants, as a shorter lever reduces the forces imposed on the implant (28,29).

In contrast to that studies showed complications developed by intramedullary implants that include cut-out, femoral shaft fractures at or distally to the distal end of the nail (29,30). The rate of femur shaft fractures following implantation of first-generation intramedullary nails was 5.3% (31). Improvements in the design of intramedullary nails reduced the risk of cut-out and improved rotational stability (32). Also, the risk of femur shaft fractures reduces with the updated designs of the intramedullary nails (33). The changes in design let to the rise of other complications. The Z-effect phenomenon describes the collapse and protrusion at the femoral head and neck (34,35).

Another complication that is documented after implantation of Proximal Femur Nail Antirotaion is the varus fixation. Many complications have a higher incidence associated with osteoporosis (36). Some studies report implant failure rates of 3-16.5% (37). Other studies even report complication rates of up to 50% in unstable intertrochanteric fractures associated with osteoporosis (38).

Complications also include adverse events that include other general health conditions.

The incidence of complications regarding medical postoperative complications is studied taking all proximal femur fractures into account, as the problems arising are similar. Up to 20% of patients treated for fractures of the proximal femur experience postoperative complications (39). Cognitive impairments appear in about 10% of patients after surgery in the hip region (40). The cardiac mortality exceeds 20% in patients after hip surgery after one year (41). Pulmonary complications are another reason for increased mortality and morbidity, as well as prolonged hospital stays. It occurs in 4% of the patients after surgery (42). Other complications include gastrointestinal, urinary tract, hematologic and endocrine- metabolic complications.

Fractures of the proximal femur and fractures of the hip are associated with different adverse outcomes. First, the mortality remains high. It is reported that the one-year mortality is greater than 20% (43). The mortality risk is furthermore high even beyond five years (44). But mortality is not the only factor that needs to be considered. Functional outcomes for patients with hip fractures is poor in many cases. Studies assessing the functional capabilities of patients one year after the fracture occurred report that nearly 40% of the patients are unable to walk independently, 33% of the patients are totally dependent and 60% over all need assistance (43,45).

OUTCOME

Other indicators and parameters have been established to not only take life expectancy into account but also take the quality of life into the perspective. One of those parameters is the disability-adjusted life-year (DALY). One study found the burden of hip fractures in the US to be 27 DALYs per 1000 individuals translating into 2.7% average loss of healthy life expectancy. The authors translate the numbers into disability dominating over mortality and emphasising the importance of measuring the outcomes of hip fractures not only by mortality factors but also disability. As well emphasising the relevance of choosing the right treatment modality for patients to prevent loss of independence (46).

The risk of operation associated complications is contributed to by different factors and co-morbidities.

For the prevention of complication early postoperative mobilization with full weight-bearing is one of the major factors. It is associated with decreased pulmonary complications, reduced pressure sores, preventing generalised deconditioning and a shorten mean length of the hospital stay (47). On the other hand, has a prolonged immobilization been associated with higher mortality rates (48).

One of the most prominent underlying co-morbidities in the osteosynthesis of intertrochanteric fractures is osteoporosis. It is reported that in patients with osteoporosis the rate of implant failure is significantly higher, resulting in prolonged immobilization with associated adverse outcomes following (38).

To avoid the mechanical and implant related complications in this high-risk groups different authors have proposed to use hemiarthroplasty in patients with intertrochanteric fractures, but especially in those with unstable intertrochanteric fractures (49).

Hemiarthroplasty is often used in patients after those develop complications. To prevent reoperation studies suggest using hemiarthroplasty as first line treatment for high-risk patients (50).

ARTHTOPLASTY

For the replacement of the hip joint two different modalities are available. While in the hemiarthroplasty only the femoral component of the hip joint is replaced, in the total arthroplasty also the acetabular component is replaced.

Hemiarthroplasty describes a partly replacement of the joint. There are two different implant devices available, including unipolar hemiarthroplasty as well as bipolar hemiarthroplasty.

During the procedure the femoral head and neck is resected and replaced by an implant. The endoprosthetic head articulates with the body´s own acetabulum. Compared to the unipolar hemiarthroplasty the bipolar hemiarthroplasty has an additional bearing on the inside between the stem and the head component. This reduces the shear forces in the joint (51). Bipolar hemiarthroplasty has a decreased acetabular erosion and decreased pain compared to unipolar hemiarthroplasty. Nevertheless, the benefits of the bipolar hemiarthroplasty become prevalent after two years of implantation (52).

The different implants can either be cemented or cementless placed in the femoral shaft.

Compared to the hemiarthroplasty arthroplasty also includes an artificial replacement of the acetabular component of the hip joint. Within the acetabular component an liner made out of plastic is placed.

CURRENT STUDIES

As for today hemiarthroplasty plays a bigger role in the primary treatment of intertrochanteric fractures compared to the total arthroplasty.

To summarize the current opinion showed in studies there are 27 studies that are meeting the inclusion criteria (53–81) . The oldest study from the included is from 2014 while the most recent ones are from 2023. All studies combined included over all 9450 patients averaging

363.46 patients. The median of patients included is 75. The smallest included patient amount is 30 (58). The biggest study is composed of 7223 patients (54). The studies are focusing on different topics and work with different hypothesis. In most studies the inclusion criteria include an older age than 60 or 65 years. Some evaluating the safety of primary hemiarthroplasty in all patients, while other are focusing on the elderly population. Others are comparing the functional outcome of either cemented or uncemented hemiarthroplasty to different osteosynthesis modalities.

Over all 13 of the studies are in favour of hemiarthroplasty as primary treatment for intertrochanteric femur fractures. While seven studies showing disadvantages for hemiarthroplasty as primary treatment for intertrochanteric femur fractures. These 7 studies include 7768 patients. The other 7 studies do not show an advantage for neither of the treatment modalities.

Three of the studies that are not in favour found, that the functional outcome of both treatment modalities is similar, but the rate of complications in the hemiarthroplasty group are higher.

All three studies show that after three months the functional outcome is better in the hemiarthroplasty group, after 6 months there are no significant differences in the functional outcome and after 12 months the osteosynthesis is superior in the aspect of functional outcome (68,70,80).

Other studies found no significant differences except for the higher surgical trauma for hemiarthroplasty (75).

The biggest included study with 7223 patients is a retrospective study from South Korea. The authors state, that the mortality in the hemiarthroplasty group is higher compared to the osteosynthesis group. Especially in the subgroup analysis it shows the increased risk for mortality for female patients aged 65-79 years (54). Two other studies are concluding that hemiarthroplasty should not be used especially in elderly patients. Those two studies are stating that the functional outcome and mortality rate are similar in both compared groups, but the rate of complications is significantly higher in the hemiarthroplasty group (64,70).

On the other hand, ten different studies describe hemiarthroplasty as an secure option and three studies even stating that hemiarthroplasty has less complications compared to the osteosynthesis group (55,56,58,59,62,63,71,72,74,78).

One advantage of hemiarthroplasty, that is showed by 11 different studies is the earlier weight bearing compared to the osteosynthesis group. It is believed that the earlier return to full weight bearing might have a negative association to the rate of multiple non-operation associated complications. This is outlined by Cai C. et al. They show that hemiarthroplasty can be used to

provide faster recovery for patients of the elderly population. They also point out the problems of part weight bearing using crouches in elderly patients. Usually, those patients do not have enough upper body strength to walk on crouches and by that the mobilization is further delayed (66).

Three different studies describe hemiarthroplasty in intertrochanteric fractures especially in multimorbid patients as a better alternative. Park et al. describe osteosynthesis in healthy patients with good bone quality as the better choice, but in patients with severe commination of the fracture or poorer bone quality hemiarthroplasty is a good alternative. It shows advantages in an earlier return to an ambulant setting, a lower risk of reoperation and reduced pain in the beginning (67).

A similar conclusion is made by Jin Z. et al. Their study showed the advantages of hemiarthroplasty especially in patients aged 90 years or older (63). They state there is no difference in survival outcomes or functional outcome in the compared groups, hemiarthroplasty, and Proximal Femur Nail Antirotation, but in patients older than 90 years the functional outcome in the PFNA group decreased significantly more compared to the hemiarthroplasty group.

The studies concentrating on arthroplasty as a treatment for intertrochanteric fractures come to similar results as the ones concentrating on hemiarthroplasty. Four different studies describe arthroplasty in hip fractures as an valuable treatment option (82–85). But what is underlined and especially in the focus of the study published by Solarino et al. is the high risk of peri- and postoperative complications (86). With periprosthetic acetabular fractures adding up to 4.2% of the patients in this study, an additional source of possible complications is associated with this treatment modality. With being a long-term solution for the treatment, the patients have a high expectation regarding the implant and the outcome. But the anatomical conditions of an intertrochanteric fracture, that might be unstable, the implantation of the prothesis is aggravated.

DISCUSSION AND RECOMMENDATIONS

Intertrochanteric fractures combined with other hip fractures are a raising burden for an aging population. The incidence of this fracture type is increasing, and age-related comorbidities are not only contributing to this trend, but also complicating the treatment. Osteoporosis is one underlying condition, that not only leads to an increase of this fracture type, but also has an influence on the outcome of the treatment. Especially in elderly patients the prevalence is high.

Over the time different treatment modalities have been developed to improve the outcome of intertrochanteric fractures. But still in osteoporotic unstable intertrochanteric fractures the failure rates of osteosynthesis remain high. Both intermedullary and extramedullary implants have good results in healthy patients with good bone quality but are challenged with poor bone quality and slowed bone healing. Delayed mobilization, loss of independence, higher mortality rates, decreased functional outcome are a few hazards caused by implant failure or implant related complications. Those include for example cut-out, non-union and Z-effect phenomenon.

By bypassing the risk of failed osteosynthesis different scientists have proposed to treat elderly patients with a high risk of adverse outcome with hemiarthroplasty. Hip hemiarthroplasty is a well known and scientific procedure used especially in intracapsular proximal femur fractures. The overall picture of current studies comparing the outcome of hemiarthroplasty with the outcome of osteosynthesis in intertrochanteric fractures is heterogenic.

On the one hand several studies show the safety of hemiarthroplasty in intertrochanteric fractures by itself and compared with osteosynthesis procedures. On the other hand, other studies are opposing this and show higher rates of complications compared to osteosynthesis.

Other studies comparing the mortality rates also show ambivalent results. Some studies explicitly outline the possible role of hemiarthroplasty in elderly patients, while other studies in contrast to this warn about using hemiarthroplasty in this patient group due to the poorer outcome and higher complication rate risks.

Regarding the functional outcome it becomes clear that hemiarthroplasty has an advantage in the early postoperative period. Up to 6 months after the surgery the functional outcome is superior in patients treated with hemiarthroplasty. At 6 months the outcome is similar and after 12 months inferior compared to patients treated with Proximal Femur Nail Antirotaion. This might correlate with the immediate full weight-bearing allowed by after the hemiarthroplasty. This offers an opportunity in patients that are at a high risk of complications and especially at risk for a decrease in general health in the early postoperative period.

The role of arthroplasty in the treatment of intertrochanteric today is limited, as well as in the scientific work. With additional surgical trauma during the implantation on the one side and a lack of additional solution for current problems in the treatment of these fractures compared to hemiarthroplasty, its role is a smaller than the hemiarthroplasty.

The comparability between the different studies and the significance of the individual studies by itself is limited. With a median of 75 patients per study the sample is rather small. This leads

to limitations in finding differences between subgroups. This could either be subgroups divided by age, underlying diseases, or the presence of osteoporosis.

Furthermore, is the comparison aggravated by different treatment modalities that are compared within the studies. Treatments of the same fracture differ around the world. This is due to restricted availability of certain products in some countries, financial reasons, and the treatment culture in each country. This leads to the fact that for the osteosynthesis treatment different implant generations of intramedullary nails or different generations of dynamic hip screws are used in different studies. Also, for the hemiarthroplasty different surgical techniques and products are used. There are cemented and cementless implants used, as well as the stem length varies. In some studies, short stems are used and compared, while in other studies long revision stems are used for the primary treatment. Another difference is the use of monopolar or bipolar hemiarthroplasty in various studies.

In the end hemiarthroplasty might be a useful option for intertrochanteric fractures in specific patient groups. To identify those who might benefit from a hemiarthroplasty compared to osteosynthesis, and those who might be harmed by this treatment modality, more and larger scientific work is needed. This scientific work can later translate into clinical recommendations.

With an aging population, that has more underlying health conditions, further scientific evaluation of the treatment of intertrochanteric fractures is needed.

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