

# Orthopaedic surgeons prefer new expensive technology for treatment of hip fractures: an international survey on the surgical practices

Morsi Khashan<sup>a</sup>, Eyal Amar<sup>a</sup>, Ran Lador<sup>a</sup>, Gil Eyal<sup>b</sup>, Moshe Salai<sup>a</sup> and Ofir Chechik<sup>a</sup>

## ABSTRACT

### Background:

The health care expenditures for the management of hip fractures are growing along with the rise in their prevalence. The ideal method of surgical treatment for hip fractures is controversial. The present survey aimed to determine the current international practices of the management of these fractures and to compare the findings with the available evidence.

### Methods:

We distributed questionnaires to orthopaedic surgeons at the Annual Meeting of the American Academy of Orthopedic Surgeons (AAOS) 2011 and the 12th meeting of the European Federation of National Associations of Orthopaedics and Traumatology (EFFORT). The following questions were asked: (1) In a displaced intracapsular hip fracture in an elderly patient, what is your treatment of choice? (2) In 31A1 and 31A2 hip fractures, what is your preferable implant for fixation?

### Results:

The total number of responders was 291 from 57 countries. For the first question, 47% of the responders chose bipolar arthroplasty, 32% unipolar, 14% total hip replacement, and 7% open reduction internal fixation. For the second question 51% chose dynamic hip screw, 46% preferred an intramedullary device, and 3% chose other treatment modality. For both questions these choices were not influenced significantly by geographic origin, area of specialty, or the seniority status ( $P = 0.25$ ).

### Conclusions:

While the common practice in the surgical treatment choice for intracapsular fracture of the elderly is not evidence based, the surgeons' preferences are consistent with available evidence in the choice of surgical treatment for extracapsular hip fractures. The popularity of intramedullary devices for intertrochanteric

fractures and bipolar hemiarthroplasties for intracapsular fractures is unjustified in light of their high relative costs.

### Key Words

hip fractures, intracapsular, extracapsular, fixation, arthroplasty

## INTRODUCTION

The prevalence of hip fractures has been growing steadily and is expected to rise further with the aging of the population.<sup>1,2</sup> The annual healthcare expenditures for these fractures in the United States are soon expected to surpass \$15 billion.<sup>3,4</sup> The high rate of the associated mortality (up to 30%<sup>5</sup>), morbidity, and functional impairment<sup>6</sup> accounts for the major impact of these fractures on public health systems.

Based on the pathoanatomy and the subsequent prognosis, proximal hip fractures usually are divided into two major categories: extracapsular or intracapsular. Intertrochanteric hip fractures are extracapsular and involve the area between the two trochanters. The abundant blood supply makes this area less susceptible to osteonecrosis and nonunion than intracapsular fracture.<sup>7</sup> These fractures are classified as 31A1 and 31A2 according to the AO/OTA.<sup>8</sup> It is evident that surgical fixation is superior to conservative management for these fractures.<sup>7,9</sup> Yet, the optimal device for fixation; dynamic hip screw (DHS), intramedullary device (IMD) or other, remains controversial.<sup>7,10</sup>

Intracapsular fractures occur in the femoral neck area. The limited blood supply and its potential disruption by the displaced fracture leads to substantial risk of osteonecrosis and nonunion, reaching up to 30% in elderly patients with poor bone quality treated by internal fixation.<sup>11,12</sup> Surgical treatment is preferred for these fracture because of the lower rates of subsequent displacement, morbidity, and mortality as compared to conservative treatment.<sup>12</sup> Arthroplasty results in lower reoperation rates, nonunion, and osteonecrosis when compared with fracture fixation; however, it is associated with greater initial surgical trauma, operative time, and blood loss.<sup>10,12–15</sup> It is, therefore, controversial which procedure to choose for the treatment of a displaced intracapsular fracture.<sup>13–15</sup> Furthermore, among the arthroplasty options, the choice between the different hemiarthroplasty systems or total hip replacement (THR) also is debatable.<sup>14,16</sup>

<sup>a</sup>Orthopedic Surgery Division, Tel-Aviv Sourasky Medical Center, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

<sup>b</sup>Orthopedic Surgery Department, Rabin Medical Center, Petah Tikva, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel  
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Correspondence to Morsi Khashan, MD, Department of Orthopedic Surgery, Tel-Aviv Sourasky Medical Center, 6 Weizmann St., Tel-Aviv 64239, Israel

Tel: +01(415)3168979; fax: +972-36974546;

e-mail: Morsi.kh@gmail.com

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Orthopaedic surgeons ideally should use evidence to guide their treatment. Prospective randomized clinical trials are considered the best quality of evidence, and they are the source for systematic reviews and meta-analyses, comprising level-1 evidence and guiding clinical decision making.<sup>17,18</sup> While physicians are expected to rely on evidence, other factors, such as marketing, peer pressure, preliminary data, or lower quality of evidence, and tradition, also influence decision making.<sup>17</sup> These factors may have more weight when high-quality evidence is not available or evidence is inconclusive.<sup>18</sup>

The purpose of this survey was to determine the current international trends and common practices in the surgical treatment of extracapsular fractures as well as displaced intracapsular hip fractures in the elderly population. We aimed to compare these trends and practices with the available evidence in the literature. We hypothesized that a surgeon's experience, country of origin, and area of expertise would influence choices, together with published level-1 evidence. Our hypothesis was that surgeons' common practices do not fully correlate with the available evidence.

## MATERIALS AND METHODS

To determine the study questions, a "Pubmed" search was conducted in January 2011 using the key words "proximal femur" or "proximal femoral" or "hip" + "fracture," and limited to randomized controlled trials, meta-analysis, or systematic reviews. In our analysis we included surgical treatment modalities for which we could identify the largest amount of evidence, namely, randomized controlled trials, meta-analyses, and systematic reviews. The questionnaire was composed of two multiple-choice questions on the surgeon's preferences:

- (1) In a displaced intracapsular hip fracture in an elderly patient, what is your treatment of choice?

Answers: open reduction and internal fixation (ORIF), unipolar hemiarthroplasty, bipolar hemiarthroplasty, total hip replacement (THR).

- (2) In 31A1 and 31A2 hip fractures, what is your preferable implant for fixation?

Answers: dynamic hip screw (DHS), intramedullary device (IMD), Other

The questionnaire was distributed to orthopaedic surgeons at two major international conferences held in the United States and Europe: The Annual Meeting of the American Academy of Orthopedic Surgeons (AAOS) held in San Diego, February 2011, and the 12th European Federation of National Associations of Orthopaedics and Traumatology (EFFORT) held in Copenhagen, June 2011. The questionnaires were printed and distributed by the three of the authors at each conference. All participants were chosen randomly without knowing their demographic or professional data. Participants were recruited in the conference center during breaks and between the different sessions. The questionnaires were collected upon completion by the authors.

After analyzing the survey results for the preferred treatment, the results were compared to the gold standard

evidence. For this an electronic search was carried out, using the databases PubMed and the Cochrane Central Register of Controlled Trials (CENTRAL). We reviewed available randomized controlled trials, meta-analyses, and systematic reviews of highest quality.

## Statistical Analysis

A univariate analysis was performed using the chi-square test to detect significant differences in choices between surgeons from different regions of the world, different subspecialties (trauma, arthroplasty, etc.), and different levels of experience (seniors, fellows, or residents). The level of significance was set at 0.05. The IBM® (Armonk, New York, U.S) SPSS® 19 for Windows was used for all analyses.

## RESULTS

The total number of responders was 291 from 57 different countries (53% from Europe, 24% from North American, 13% from Asia, 7% from South America and 3% from Africa). Forty five percent were senior surgeons, 11% fellows, 17% residents, and 27% did not mention their status. Analyzing the subspecialty of the responders revealed 10 different subspecialties of which 24% were arthroplasty and 11% were trauma specialists (Table 1).

A total of 280 surgeons (96% of participants) answered the first question. One hundred thirty one responders (47%) chose bipolar arthroplasty, 89 (32%) unipolar hemiarthroplasty, 40 (14%) THR, and 20 (7%) ORIF (Table 2). This choice was not influenced significantly by geographic origin ( $P=0.65$ ), area of specialty ( $P=0.52$ ), or the seniority status ( $P=0.25$ ). Within the groups of arthroplasty and trauma surgeon, no significant difference was noted when the participants were stratified according to their geographic origin ( $P=0.35$ ) or seniority grade ( $P=0.22$ ) (Table 2).

The response rate for the second question was 95% (275 surgeons), among which 139 (51%) chose DHS, 128 (46%) IMD, and 18 (3%) chose other treatment modality (Table 3). The geographic origin ( $P=0.68$ ), the subspecialty ( $P=0.69$ ), and the seniority status ( $P=0.21$ ) did not influence the treatment choice significantly (Table 3).

## DISCUSSION

The purpose of this survey was to determine the current trends and common practices in the treatment of

**TABLE 1.** Characteristics of the entire group of responders

Geographic origin	Seniority status	Subspecialty
Europe 154 (53%)	Seniors 131 (44%)	Arthroplasty 71 (24%)
North America 70 (24%)	Fellows 32 (11%)	Trauma 32 (11%)
Asia 38 (13%)	Residents 49 (17%)	Other 188 (65%)
South America 20 (7%)	Other 79 (27%)	
Africa 10 (3%)		

**TABLE 2.** Surgeons' preferences for the treatment of displaced intracapsular hip fractures in the elderly

	Unipolar hemiarthroplasty	Bipolar hemiarthroplasty	THR	ORIF	Total	P-value
All participants	89 (32%)	131 (47%)	40 (14%)	20 (7%)	280	0.65
Geographic origin						
North America	23 (35%)	30 (46%)	11 (17%)	1 (2%)	65	0.289 (VS other continents)
Europe	50 (34%)	66 (45%)	20 (14%)	11 (7%)	147	0.763 (VS other continents)
Other	16 (24%)	35 (51%)	9 (13%)	8 (12%)	68	0.166 (VS other continents)
Subspecialty						0.52
Arthroplasty	20 (29%)	27 (40%)	16 (24%)	5 (7%)	68	0.169 (VS other subspecialties)
Trauma	11 (35%)	16 (52%)	2 (6%)	2 (6%)	31	0.783 (VS other subspecialties)
Other	58 (32%)	88 (49%)	22 (12%)	13 (7%)	181	0.716 (VS other subspecialties)
Seniority Grade						0.25
Senior	34 (25%)	63 (49%)	23 (18%)	8 (6%)	128	0.141 (VS other seniority grades)
Fellow	14 (44%)	15 (47%)	3 (9%)	0 (0%)	32	0.213 (VS other seniority grades)
Resident	17 (38%)	19 (42%)	5 (11%)	4 (9%)	45	0.388 (VS other seniority grades)
Other	24 (32%)	34 (45%)	9 (12%)	8 (11%)	75	0.461 (VS other seniority grades)

THR, Total hip arthroplasty; ORIF, Open reduction internal fixation, VS, versus.

extracapsular and displaced intracapsular hip fractures in the elderly among orthopaedic surgeons worldwide. We also aimed to determine whether their choices are supported by published evidence-based data or affected by country of origin, area of expertise, or other professional characteristics.

### Intracapsular Hip Fractures

Choosing surgical treatment for intracapsular fractures is not a straight forward choice.<sup>14</sup> The available evidence indicates that for a displaced fracture in elderly patients, internal fixation results in higher rates of nonunion and reoperation as well as inferior function compared with arthroplasty.<sup>12,13</sup> The benefits of internal fixation are less surgical trauma, shorter operative time, less blood loss, and lower infection rates.<sup>12-14</sup> However, it is believed that the risks of fixation compared with arthroplasty outweigh the benefits.<sup>14</sup> In a Cochrane systematic review comparing arthroplasty with internal fixation for intracapsular fractures, Parker<sup>15</sup> found that while the length of surgery, operative blood loss and risk of deep wound infection were significantly less for internal fixation, fixation had a significantly higher reoperation rate.<sup>15</sup> No definite differ-

ences in hospital stay, mortality, or regaining preinjury residential state were found.<sup>15</sup> Butler *et al.*<sup>16</sup> in their recent systematic review found that the available randomized controlled trials indicate no difference in the mortality rate by either ORIF or arthroplasty use or by the use of different arthroplasty systems including THR.<sup>16</sup>

An increasing body of evidence suggests that for healthy, independent, elderly patients THR results in a better functional outcome than hemiarthroplasty and should be considered the treatment of choice for these patients.<sup>12,19</sup> Butler *et al.*<sup>16</sup> reported a randomized controlled trial analysis proving that THR resulted in less pain and improved function over hemiarthroplasty and internal fixation. However, these differences were only significant for the first year.<sup>16</sup> In a recent Cochrane review, some evidence was found showing that a THR leads to better functional outcome than a hemiarthroplasty.<sup>20</sup> Comparing unipolar and bipolar hemiarthroplasty systems, the results of seven randomized controlled trials demonstrated no significant difference in outcome.<sup>20</sup> The authors found good evidence showing that cementing the prostheses in place will reduce postoperative pain and lead to better mobility.<sup>20</sup>

**TABLE 3.** Surgeons' preferences for the treatment of extracapsular hip fractures

	DHS	IMD	Other	Total	P-value
All participants	139 (51%)	128 (46%)	8 (3%)	275	0.68
Geographic origin					
North America	32 (50%)	32 (50%)	0 (0%)	64	0.469 (VS other continents)
Europe	70 (48%)	69 (48%)	6 (4%)	145	0.587 (VS other continents)
Other	37 (56%)	27 (41%)	2 (83%)	66	0.656 (VS other continents)
Subspecialty					0.69
Arthroplasty	30 (44%)	35 (51%)	3 (4%)	68	0.464 (VS other subspecialties)
Trauma	15 (48%)	16 (52%)	0 (0%)	31	0.471 (VS other subspecialties)
Other	94 (53%)	77 (44%)	5 (3%)	176	0.390 (VS other subspecialties)
Seniority Grade					0.21
Senior	65 (52%)	59 (47%)	1 (1%)	125	0.285 (VS other seniority grades)
Fellow	19 (61%)	11 (35%)	1 (3%)	31	0.513 (VS other seniority grades)
Resident	28 (62%)	15 (33%)	2 (4%)	45	0.154 (VS other seniority grades)
Other	27 (36%)	43 (58%)	4 (5%)	74	0.088 (VS other seniority grades)

DHS, dynamic hip screw; IMD, intramedullary device; VS, versus.

In this study, participants substantially preferred arthroplasty over ORIF, a choice that is supported by evidence.<sup>14,15</sup> While the literature indicates no advantage of any hemiarthroplasty over another<sup>14,20</sup> and some functional advantage of THR over hemiarthroplasty,<sup>12,14,20</sup> hemiarthroplasty was largely preferred in this survey (47% compared to 32% for unipolar and 14% for THR). This may be explained by the fact that THR is a more complex procedure<sup>21</sup> requiring more experienced and sometimes specialized surgeons.<sup>21</sup> Indeed, surgeons who specialize in joint replacement tend to perform more THR (24%). Another possible explanation for not choosing THR is the higher initial cost of the implants.<sup>21</sup> Nevertheless, when the initial episode and the subsequent hip-related admissions costs are compared, THR actually conferred a cost advantage compared to ORIF and to hemiarthroplasty.<sup>21</sup>

The preference of bipolar over unipolar arthroplasty in the present survey might be due to the theoretical mechanical advantage of the two articular surfaces provided by the bipolar implants that are usually used for marketing purposes. The Swedish hip arthroplasty registry report 2009 found a correlation between the use of bipolar implants and higher reoperation rate.<sup>21,22</sup> After that, the registry's annual report in 2010, which included around 26,000 patients, showed 94% were performed in fracture cases<sup>22</sup> demonstrating an increase in the use of unipolar and a decrease in use of bipolar implants.<sup>20</sup> This correlation is not well established in level 1 studies. The lack of outcome advantage should raise some questions regarding the preference of bipolar implants in light of our survey's results.

Our findings about intracapsular fractures indicate a significant discrepancy between the available evidence and the common practice as shown by the surgeon's preference of arthroplasty systems. The common practice in the surgical treatment choice of these fractures is not affected by the geographic origin, surgeon subspecialty, or the seniority grade. It is yet to be seen if THR becomes the first choice for intracapsular hip fracture, as the literature suggests.

## Extracapsular Hip Fractures

For extracapsular fractures the currently available literature indicates a superior outcome of surgical over conservative treatment.<sup>7</sup> DHS and IMD are the most commonly used systems for the management of OA/OTA 31A1, 31A2 fractures. Most level 1 studies demonstrate no significant difference in mortality, pain, function, operating time, blood loss, functional outcomes, or union rate in patients treated with plate and screw as compared with IMD.<sup>7,10,16</sup> Kaplan *et al.*<sup>7</sup> in their comprehensive review failed to find evidence supporting the superiority of these devices. Based on their experience the authors recommended either device for stable fracture and IMD for the unstable ones.<sup>7</sup> In a recent Cochrane systematic review comparing DHS to IMD, Parker<sup>10</sup> found that mortality, wound infection rates, and functional outcome were similar for both devices. The overall rates of reoperation, operative and postoperative femoral fractures, and fracture fixation complications were found to be higher with IMD. The authors concluded that

the use of DHS is superior for intertrochanteric fractures.<sup>10</sup> In a recent systematic review by Butler *et al.*<sup>16</sup> the overall analysis of randomized controlled trials resulted in similar mortality rates and functional outcomes regardless of device used. IMDs were associated with more pain but also earlier improvement in weight bearing and mobility. The advantage was found to be temporary and became insignificant within several months to 1 yr.<sup>16</sup>

Our results reveal that the geographic distribution and the field of expertise did not affect the answers significantly. Surgeons' preferences were distributed almost equally between DHS and IMD (51% and 46%, respectively). This fact is consistent with the available evidence, which indicate similar outcomes for the two devices with a slight superiority of DHS.<sup>7,10,23</sup>

Between the years 1999 to 2006, a dramatic change occurred in surgeon preference of fixation devices used in the treatment of intertrochanteric fractures, mainly among young orthopaedic surgeons, with the IMD rate increasing from 3% to 67%.<sup>24</sup> This change has occurred despite a lack of supporting evidence<sup>24</sup> and despite the fact that IMDs are much more expensive than DHS by 45–400%.<sup>24–27</sup> This cost difference has a substantial effect on the health care systems due to the very high prevalence of these fractures. The high implant cost together with high quality evidence for its equal or even inferior outcome compared with DHS, raises questions regarding the equal preference of these devices. Previous studies have raised this question as well. Anglen and Weinstein<sup>24</sup> suggested possible explanations, including attraction to new technology, the need to offer new technology, and the belief that IMD procedures are easier and shorter.

IMD popularity in extracapsular fractures and bipolar implants in intracapsular fractures in the absence of evidence that favors these high expense devices compared with others that are just as effective is not trivial. In fact, this raises another question about considerations, besides evidence, that guide surgeons' choice of an implant. Marketing, peer pressure, and preliminary data have been suggested in this regard.<sup>17</sup> In the case of IMD for intertrochanteric fractures, other factors also may influence the implant of choice, such as the simplicity of application, smaller surgical incisions, and better cosmetic results and hence greater patient satisfaction. However, none of these can justify the choice of the cumulative cost difference for health care systems in the absence of supportive data for better outcomes. Greenhalgh<sup>28</sup> suggested that a number of conditions must be fulfilled before a new technology is adopted readily by individual health professionals. The evidence should be unequivocal and of high quality; the user of the technology must personally believe that it is effective; he should have the opportunity to try out the intervention in controlled circumstances; possible adverse effects of the technology should be placed in proportion to the likely benefits; and clinical conflicts of interest should be identified and explored. These criteria are not met in the both cases of IMD and bipolar hemiarthroplasty, and their choice is unjustified in light of their high cost.

In conclusion, the common practices and trends in the surgical treatment choice of intracapsular fractures in the



elderly are not evidence based. These trends are consistent with available evidence of the choice of surgical treatment for extracapsular hip fractures. No significant influence of the geographic origin, area of expertise, or the seniority grade was recorded. The popularity of IMDs for intertrochanteric fractures and bipolar hemiarthroplasty for intracapsular ones is unjustified in light of their high relative costs.

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