

## Outcome Analysis of Obesity in Trauma Surgery Related to Closed Injuries of Lower Limb in Orthopedic Surgery

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### Abstract

**Background:** Obesity is fast becoming a global epidemic and has profound effect on lower limb trauma surgeries is not well defined. This study aimed to evaluate and investigate the influence of obesity on health related quality of life (HRQL), patient reported outcome, incidence of postoperative surgical site infection (SSI), perioperative and postoperative complications. The specific association of obesity and outcome is not examined and measured previously in trauma surgery of lower limbs.

**Methods and Materials:** During 2005 to 2014, a total of 12853 patients underwent different lower limb trauma surgeries and outcome measurement was based according to Body Mass Index (BMI). 10885 Patients with BMI of < 30kg/m<sup>2</sup> were classified as non-obese and used as control groups. 1968 Patients with BMI of ≥ 30 kg/m<sup>2</sup> were classified as obese and data analyzed in terms of outcome, adverse effects, complications and health related quality of life (HRQL)

**Results:** The Increase in BMI leads to increased perioperative complications in terms of Intubation difficulty, blood loss, and duration of surgery. The post-operative adverse incidences in early period like deep venous thrombosis (DVT), surgical site infections (SSI), cardiac and renal events, superficial and deep infections were significant statistically. The delayed adverse effects relate to complications like late development of surgical site infection (SSI), implant loosening and orthopedic implant failure, re-operation rates for different complications. The improvement in health related quality (HQRL) is low among obese patients.

**Conclusions:** Obesity has an inverse influence on patient outcome as compared to non obese patients. However, despite these increased obese patients do benefit from trauma surgeries of lower limb and patient reported outcome was found to be slightly lower among obese patients.

**Keywords:** Body mass index (BMI); Closed injuries; Health related quality of life (HRQL); Lower extremity; Non obese; Obese; Surgical site infection (SSI)

### Introduction

Obesity is a condition of abnormal or excessive accumulation of adipose tissue over body that impairs individual health. World health Organization termed obesity as body mass index (BMI) greater than or equal to 30. BMI is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m<sup>2</sup>). Between 1980 and 2014, the worldwide prevalence of obesity is more than doubled, posing a health risk. In 2014, an estimated more than 1.9 billion adults, 18 years and older, were overweight. Among these 600 million were obese. Overall, about 13% of the world's adult populations (11% of men and 15% of women) were found to be obese in 2014 [1]. According to the World Health Organization (WHO), the main reason being imbalance between energy intake and energy expenditure over a prolonged period of time that gradually leads to excessive body fat accumulation to such a degree which adversely affects individuals health [2]. Body weight and BMI has been affected by several environmental, nutritional and hormonal factors. Moreover, obese subjects are more prone of being affected by type II diabetes mellitus, hypertension, cardiovascular disorders and some cancers. Body weight of the individual has been considered as one of the important determinants of Bone Mineral Density (BMD). A positive relationship between body weight or BMI and BMD has been reported in literature [3,4]. Body weight or BMI and the risk of fractures have also been shown an inverse relationship [5]. Obese women have always been considered protective against osteoporotic fractures which is not always the case. Recently the association between obesity and osteoporosis has been actively investigated from

epidemiological, clinical and basic research points of view. Obesity and osteoporotic fractures are closely connected to each other and may present common pathophysiological mechanisms. There are increasing health related risks and financial costs with the obesity epidemic that has significant impact on the orthopedic surgery practice. Patients with increased body mass index (BMI) have more chances of sustaining distal extremity injuries than are those with a normal body mass index (BMI) [6]. The risk of incidence of ankle and upper leg fractures is also found to be significantly higher in obese than non-obese women, while the risk of wrist fracture was found to be significantly lower. On the other hand obese women with fractures tend to have higher rates of comorbidities than others [7]. Obesity alone is a remarkable risk factor for wound infection, increased intraoperative blood loss and a longer operative time. The outcome of obese patients post surgery depends on the co-morbidities and the post-operative rehabilitation protocol in

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addition to the obesity factor. The post-operative rehabilitation is very important to maintain for better functional outcome, quality of life improvement; but in obese patients it is very difficult to achieve despite best available resources. We have tried to analyze the outcome of obese patients in relation to surgery of closed injuries/fractures of lower limb in orthopedic surgery. This happens to be a separate entity than surgery for arthroplasty and elective orthopedic surgery; because joint replacement surgery are elective surgery and metabolic correction can be achieved preoperatively, which is not the case with trauma surgery; where the onus is on the physician to plan early operative intervention to prevent recumbency related complications in obese individuals.

## Materials and Methods

Prospectively 12853 patients were included in the study from year 2005 to 2014 who presented with lower limb trauma. The patients independent of age were divided into two groups – Obese (BMI of  $\geq 30 \text{ kg/m}^2$ ) and Non-obese (BMI of  $< 30 \text{ kg/m}^2$ ). The non-obese group was considered as the control group. Trauma of lower limb was divided into – pelvic and acetabular fractures, hip fractures, femoral shaft fractures, knee injuries, tibial shaft fractures, ankle injuries and foot injuries. All the patients' Health Related Quality of Life (HRQL) was evaluated with SF-36v2 health survey pre-operatively. The SF-36v2 score is an evaluation of measure of functional health and wellbeing from the patients' point of view. It is easy to evaluate, valid and reliable for mental and physical health and takes only 5 – 10 mins of time. The preexisting co-morbidities of the patients were also taken into account. The patient underwent surgeries after the pre-anesthetic fitness for trauma by a same grade of orthopedic surgeon as far as a surgical training was concerned. The surgeries were performed in same operative room in the standard orthopedic operation theatre. Intra-operatively the time to intubation, blood loss, surgical time, anaesthesia time and any complication related to surgery and anaesthesia was noted. Post-operatively patients received thromboprophylaxis for deep vein thrombosis (DVT). The post-operative rehabilitation and mobilization of patients were different for different subgroup of fractures and was done according to the standard protocol. All the immediate and early post-operative complications were noted: - related to wound healing, deep vein thrombosis (DVT), and urinary tract infection (UTI). Post-operatively Health Related Quality of Life (HRQL) was evaluated for all the patients with SF-36v2 health survey scoring. The postoperative hospital stay of different fracture pattern was different and depended upon the post-operative course of recovery. Functional outcome of lower extremity was analyzed using Western Ontario and McMaster Universities Arthritis Index (WOMAC) score, which was used because it includes pain, stiffness and physical functioning of joints. Patients were assessed for follow up at 4 weeks, 8 weeks and 12 weeks. On follow up WOMAC score was assessed and any complications related to orthopedic implants or any other surgical related complications were noted and managed.

## Results

During 2005 to 2014, a total of 12853 patients underwent different lower limb trauma surgeries and were divided on the basis of Body Mass Index (BMI). The outcome measurement was grouped in two broad categories according to Body Mass Index (BMI) as obese and non obese individuals. 10885 (85.68%) Patients with BMI of  $< 30 \text{ kg/m}^2$  were classified as non-obese and used as control groups. 1968 (15.31%) Patients with BMI of  $\geq 30 \text{ kg/m}^2$  were classified as obese (Tables 1-6 and Figures 1-3).

## Discussion

Type of injury	Obese		Non obese	
	No of patients	Percentage (%)	No of patients	Percentage (%)
Pelvic and acetabular fracture	242	12.29 %	969	8.90 %
Hip fracture	576	29.26 %	2238	20.56 %
Femoral shaft fractures	112	5.69 %	872	8.01 %
Knee injuries	176	8.92 %	536	4.92 %
Tibial shaft fractures	201	10.21 %	2206	20.26 %
Ankle injuries	559	28.40 %	944	8.67 %
Foot injuries	102	5.1 %	3120	28.66 %
<b>Total</b>	<b>1968</b>	<b>100 %</b>	<b>10885</b>	<b>100</b>

Table 1: Classification of lower limb trauma according to BMI.

comorbidity	Obese		No obese	
	No of patients	Percentage	No of patients	Percentage
Diabetes mellitus	368	18.69 %	178	1.63 %
hypertension	422	21.44 %	224	2.05 %
Renal failure	84	4.2 %	14	0.12 %
GERD	94	4.77 %	70	0.64 %
<b>Total</b>	<b>968 /1968</b>	<b>49.18 %/ 100</b>	<b>486 / 10885</b>	<b>4.46 %/100</b>

Table 2: Associated preoperative co-morbidity.

This study was conducted to assess and analyze the outcome in obese patient undergoing post traumatic orthopedic lower limb surgery. In our study 85.68% subjects were non obese and taken as a control group where as 15.31% were obese. The maximum number of lower limb trauma was of hip (29.26%) followed by ankle injuries (28.40%) in case of obese subjects. Non obese patient had foot injuries (28.66%) followed by tibial shaft and hip fractures. Chaudhry [8] in his study on ankle injuries and fractures in obese patients found that the obese patients are more prone to severe ankle fractures. Ankle injuries increases with increase in Body Mass Index (BMI) and similar results were obtained by Yadagiri et al. and they concluded that the Ankle fractures occur in relatively young age group with high BMI and over activity. In a study of men and women aged 20-80 years Bergkvist et al. [9] reported that ankle fracture was significantly related to obesity. Ensrud et al. [10] in his prospective study on Body size and hip fracture risk in older women found that both lean mass and fat mass were shown to be related to hip fracture risk. In fact, he found that the subjects in the lowest quartiles of either fat mass or lean mass presented an increased incidence of risk of hip fracture. This suggest that the in lower extremity trauma there is more prevalence of hip fractures, proximal femoral injuries both in obese and non-obese subject. Ankle injuries are more common in obese due to more torso effect on ankle joint in obese subjects than that of non obese. 49.18% patients had associated co morbid medical conditions in case of obese population. Only 4.46% had co morbid medical conditions in non obese. Nguyen et al. [11] on his study on Relationship between Obesity and Diabetes in a US Adult Population demonstrate an association between increasing obesity classes and increasing prevalence of diabetes. Richard [12] on his study on obesity related hypertension found that the Obesity predisposes to hypertension and alters the course of hypertensive cardiovascular disease. The strong association of obesity with diabetes mellitus further complicates the picture in patients with such conditions. Hence, with an increase in BMI there are more chances of associated co morbid medical conditions such as diabetes mellitus, hypertension, renal

WOMAC score	Preoperative (preinjury)	Postoperative 4 weeks	Postoperative 8 weeks	Postoperative 12 weeks	Unpaired 't' test
Obese	48.21	84.26	70.28	66.18	P value 0.012 (<0.05)
Non obese	40.62	78.38	52.12	48.82	

Table 3: Mean WOMAC score analysis.

	Pre injury score	Postoperative score follow up			Unpaired 't' test
		4 weeks	8 weeks	12 weeks	
Obese	78.43	132.21	120.14	102.72	P value 0.03 (<0.05)
Non obese	68.65	122.52	92.21	78.28	

Table 4: Mean Health Related Quality of Life (HRQL) (SF- 36v2 Health Survey).

Complication	obese	Non obese	Test of Significance
Perioperative average blood loss	110.65 ml	100.87 ml	p value 0.41 (>0.05) NS
DVT	172 (8.74% of obese patients)	48 (0.44% of non obese patients)	P value 0.031 (< 0.05)
Related to wound healing (superficial or deep)	204 ( 10.36% of obese patients)	172 (1.58 % of non obese patients)	p value 0.02 (< 0.05)
UTI	102 (5.18 % of obese patients)	96 (0.88% of non obese patients)	p value 0.34 (>0.05)
Need for reoperation in early post operative time due to loss of reduction (less than 21 days)	35 (1.78 % of obese patients)	31 (0.28% of non obese patients)	p value 0.59 (>0.05)
Delayed complication (within 3 months such as implant failure, infection)	82 (4.16 % of obese patients)	196 (1.80% of non obese patients)	p value 0.01 (<0.05)
Revision surgery	70 (3.56% of obese patients)	82 (0.75% of non obese patients)	p value 0.76 (>0.05) >0.05 NS

Table 5: Perioperative and post-operative events and complications.

	obese	Non obese	Test of significance
Average surgical time	122.53 ± 21.34 min	90.43 ± 12.33 min	p value 0.021 (<0.05)
Average total hospital stay	11.67 ± 3.52 days	7.54 ± 2 .76 days.	p value 0.035 (<0.05)

Table 6: Average surgical time and hospital stay after surgery.

failure and GERD. On analysis of mean WOMAC score pre and post operatively among the obese and non obese, there was a significant improvement in mean WOMAC score in non obese (P value <0.05) as compared to obese individuals. Health related Quality of Life (HRQL) was calculated with the help of SF-36v2 health survey. Statistically significant improvement was obtained in mean SF – 36v2 score in case of non- obese subjects as compared to obese patients (p value <0.05). Fontaine [13] conducted the research in his article on obesity and health related quality of life estimated the impact of obesity on HRQL, and to determine the effects of weight reduction on HRQL. He concluded that the majority of published studies indicate that obesity impairs HRQL, and that higher degrees of obesity are associated with greater impairment of HRQL. Obesity-associated decrements on HRQL tend to be most pronounced on physical domains of functioning. Stevens et al. [14] after studying the Influence of Overweight /Obesity on Patient-Perceived Physical Functioning and Health-Related Quality of Life (HRQL) after Primary Total Hip Arthroplasty concluded that the influence of overweight/obesity on physical functioning and health related quality of life both with and without correcting for the other co variables is low. But the impact of complications and co morbidity is considerable and significant. Hence the combination of factors can rapidly lead to clinically relevant differences. This suggested that the post operative activity and rehabilitation is better in non obese patients as compare to obese patients who are associated with comorbid medical conditions. Our study also revealed a significant increase in intubation difficulty in obese individuals. Complication such as deep

vein thrombosis (DVT), delayed wound healing, implant failure and infection was found to be statistically significant in patients who were obese. The average surgical time was 122.53 ± 21.34 minutes in obese subjects and 90.43 ± 12.33 min in non obese patients. Average total hospital stay was 11.67 ± 3.52 days in obese 7.54 ± 2 .76 days in non obese individuals. Both were found to be significant statistically. Tjeertes et al. [15] on his research on whether the Obesity – a risk factor for postoperative complications in general surgery came to the conclusion that the obesity alone is a significant risk factor for wound infection, more surgical blood loss and a prolonged surgical time. Lazar et al. [16] did a study on obesity and its relationship with pelvic and lower extremity orthopedic trauma. He reported a higher incidence of intra-operative and post-operative complication in obese patients. The complications are cardiovascular, pulmonary, venous thromboembolic phenomenon and infectious complications. The intra-operative complications were nerve injuries secondary to positioning, increased intraoperative estimated blood loss, and increased operative time. Post operative complications include the early loss of reduction after surgery and implant failure. They also concluded that while operating the obese patients' special care must be taken to avoid complications and for better functional outcome. Brown et al. [17] studied the impact of obesity on the outcomes of 1,153 critically injured blunt trauma patients. He observed that the obese patients incur different injuries after severe blunt trauma than their non-obese counterparts. Despite sustaining fewer head injuries, obese patients suffer more complications, require

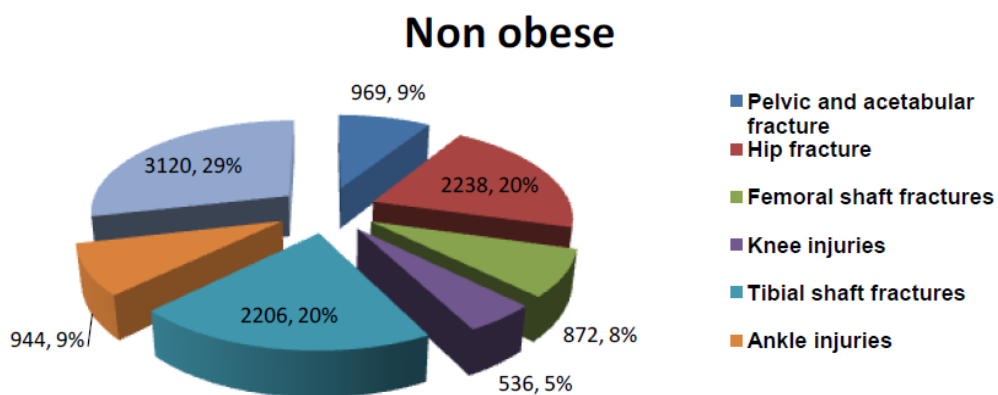


Figure 1: A. Classification of lower limb trauma in obese.

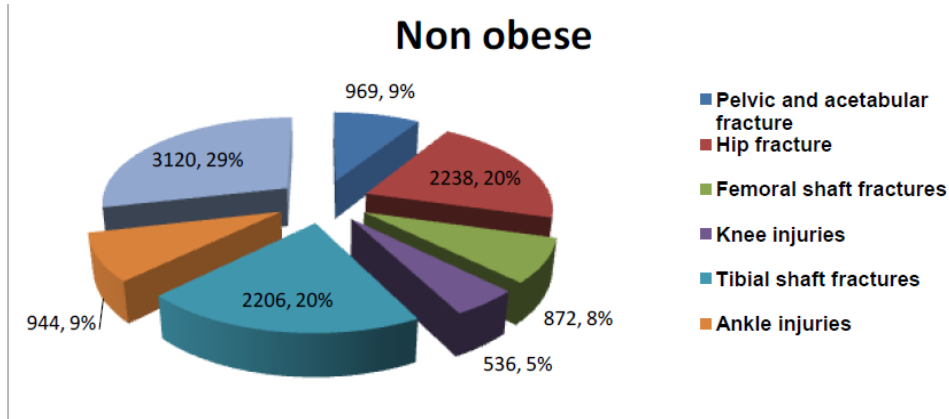


Figure 1: B. Classification of lower limb trauma in non-obese.

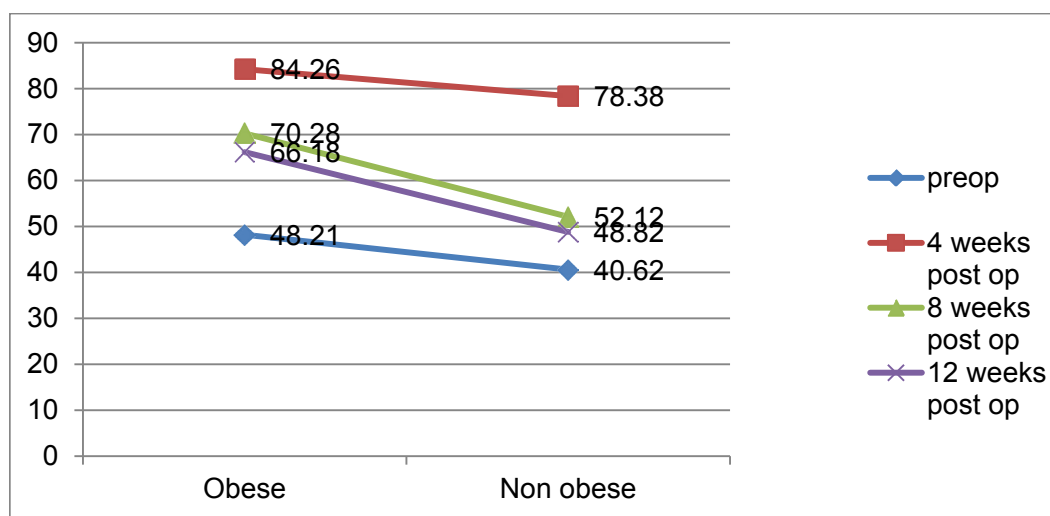


Figure 2: Diagrammatic representation of WOMAC score analysis.

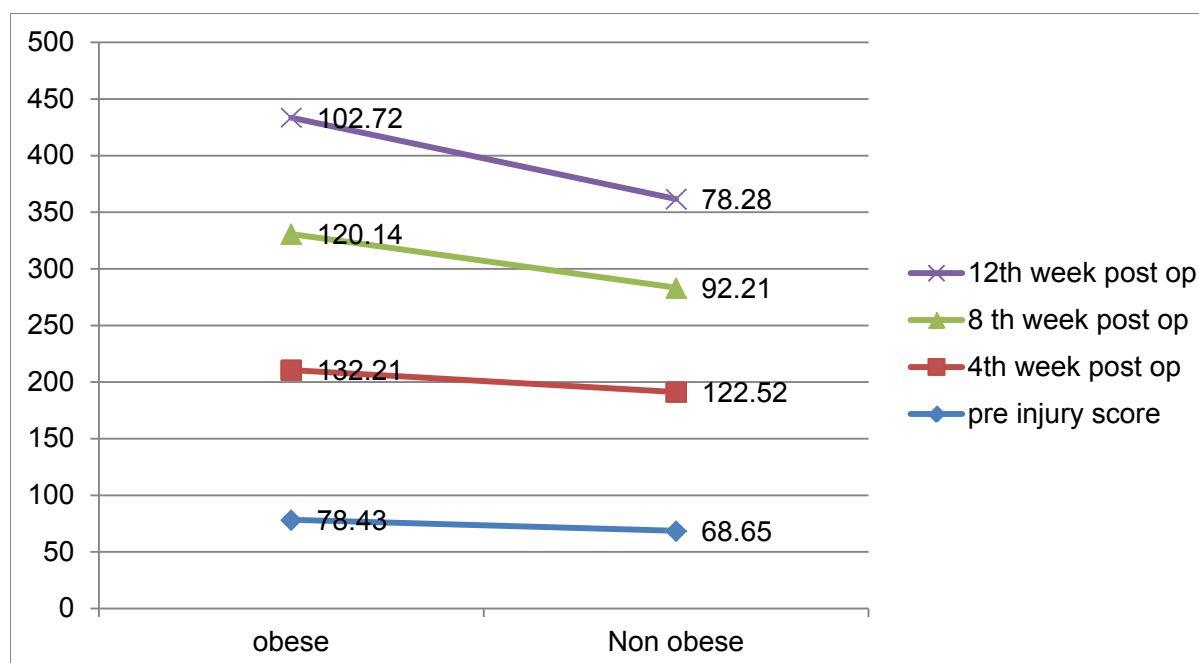


Figure 3: Diagrammatic representation of Mean Health Related Quality of Life (HRQL) (SF- 36v2 Health Survey).

longer stays in the hospital, more days of mechanical ventilation, require more time for recovery and obesity is independently associated with mortality apart from prolonged morbidity. Study was conducted to know whether BMI independently contributes to hypercoagulability after injury by Kornblith et al. [18]. He concluded that the obese trauma patients are hypercoagulable compared with their similarly injured normal-weight counterparts, which persists longitudinally after injury. Hence the obese patients are at significant pre-operative, intraoperative and post-operative complications. Hence special care must be taken while operating the patients with a BMI of  $\geq 30$  kg/m<sup>2</sup>.

## Conclusions

We conclude that the obese patients (BMI of  $\geq 30$  kg/m<sup>2</sup>) are at a significant higher risk of adverse events for the lower limb trauma and trauma related complication with respect to the operative intervention. The post operative rehabilitation of obese individuals are complex and difficult than non-obese individuals undergoing surgical intervention which leads to increased incidence of complications. Rate of complications and morbidity increases with increasing BMI. Obesity has an inverse influence on patient outcome as compared to non obese individuals, especially in trauma pertaining to lower limb. However, despite these adverse effects and increase in complications obese individuals do benefit from trauma surgeries of lower limb though the recovery, Health Related Quality of Life (HRQL) are lower and final patient reported outcome is found to be slightly lower among obese patients while comparing all the parameters. We recommend that careful planning is essential for obese individuals undergoing surgery of lower limbs and special attention is required for the obese during patient positioning, perioperative period and in terms of post operative rehabilitation. A separate protocol might help the obese individuals who are undergoing trauma surgery, especially in management of lower extremity injuries in obese patients.

## Protocol for obese individuals to be followed

**Preoperative preparation:** Proper counseling of patient about the type of trauma, risk of the procedure undergoing and the expected outcome, likely complication in perioperative period.

Anticipate complications which are likely to be encountered and do related workup. Every hospital should have a nominate faculty as anesthetic lead for obesity. The most experienced staff, both anesthetic and surgical, experienced operative room persons should help in management of obese patients. Additional specialized equipment which is necessary, should be available handy. Central obesity and metabolic syndrome should be identified as risk factors of surgery. Anaesthetizing the patient in the operating theatre should be considered with preoperative fluid and metabolic correction in preoperative arena. Regional anesthesia is recommended and desirable wherever feasible.

In an event of General anesthesia being administered, a robust airway strategy must be planned and discussed, as the obese individuals desaturate quickly and airway management at the critical time can be difficult.

**Intraoperative preparation:** Consider autologous transmission and cell saver wherever required.

Proper soft tissue handling during the surgery to minimize soft tissue trauma. Optimal surgical exposure to reduce time in the surgical operative room. Fixation should be stable and wherever necessary; biomechanically augment the fixation or the use of bone grafting might avoid unnecessary second surgery.

**Postoperative preparedness:** Appropriate prophylaxis against venous thromboembolism and early mobilization are recommended; the incidence of venous thromboembolism is considered high in the obese individuals. Postoperative intensive care support should be

considered, and is determined more by comorbidities and surgery than by obesity per se.

Measures to reduce the hospital stay.

## References

1. NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy (2001) Osteoporosis prevention, diagnosis, and therapy. *JAMA* 285: 785-795.
2. [No authors listed] (2000) Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser* 894: i-xii, 1-253.
3. Khosla S, Atkinson EJ, Riggs BL, Melton LJ 3rd (1996) Relationship between body composition and bone mass in women. *J Bone Miner Res* 11: 857-863.
4. Nguyen TV, Center JR, Eisman JA (2000) Osteoporosis in elderly men and women: effects of dietary calcium, physical activity, and body mass index. *J Bone Miner Res* 15: 322-331.
5. De Laet C, Kanis JA, Odén A, Johanson H, Johnell O, et al. (2005) Body mass index as a predictor of fracture risk: a meta-analysis. *Osteoporos Int* 16: 1330-1338.
6. Sabharwal S, Root MZ (2012) Impact of obesity on orthopaedics. *J Bone Joint Surg Am* 94: 1045-1052.
7. Felson DT, Zhang Y, Hannan MT, Anderson JJ (1993) Effects of weight and body mass index on bone mineral density in men and women: The Framingham study. *J Bone Miner Res* 8: 567-573.
8. Chaudhry S, Egol KA (2011) Ankle injuries and fractures in the obese patient. *Orthop Clin North Am* 42: 45-53, vi.
9. Bergkvist D, Hekmat K, Svensson T, Dahlberg L (2009) Obesity in orthopedic patients. *Surg Obes Relat Dis* 5: 670-672.
10. Ensrud KE, Lipschutz RC, Cauley JA, Seeley D, Nevitt MC, et al. (1997) Body size and hip fracture risk in older women: a prospective study. Study of Osteoporotic Fractures Research Group. *Am J Med* 103: 274-280.
11. Nguyen Ninh T, Nguyen XM, Lane J, Wang P (2011) Relationship Between Obesity and Diabetes in a US Adult Population: Findings from the National Health and Nutrition Examination Survey, 1999–2006. *OBES SURG* 21: 351–355
12. Re RN (2009) Obesity-related hypertension. *Ochsner J* 9: 133-136.
13. Fontaine KR, Barofsky I (2001) Obesity and health-related quality of life. *Obes Rev* 2: 173-182.
14. Stevens M, Paans N, Wagenmakers R, van Beveren J, van Raay JJ, et al. (2012) The Influence of Overweight/Obesity on Patient-Perceived . Physical Functioning and Health-Related Quality of Life After Primary Total Hip Arthroplasty. *OBES SURG* 22: 523–529
15. Tjeertes EEKM, Hoeks SSE, Beks SSBJC, Valentijn TTM, Hoofwijk AAGM et al. (2015) Obesity – a risk factor for postoperative complications in general surgery? *BMC Anesthesiology* 15: 112.
16. Lazar MA, Plocher EK, Egol KA (2010) Obesity and its relationship with pelvic and lower-extremity orthopedic trauma. *Am J Orthop (Belle Mead NJ)* 39: 175-182.
17. Brown CV, Neville AL, Rhee P, Salim A, Velmahos GC, The Impact of Obesity on the Outcomes of 1,153 Critically Injured Blunt Trauma Patients. *J Trauma* 59: 1048-1051
18. Kornblith LZ, Howard B, Kunitake R, Redick B, Nelson M, et al. (2015) Obesity and clotting: Body mass index independently contributes to hypercoagulability after injury. *J Trauma Acute Care Surg* 78: 30-36.