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Perioperative Complication Rate using Minimally Invasive Lumbar Fusion Techniques in Elderly and Obese Patients with Degenerative Lumbar Disease

Wolfgang Senker[1]*, Christian Meznik[1], Alexander Avian Mag[2] and Andrea Berghold[2]

[1]*General Hospital Amstetten, Department of Orthopedic Surgery, Krankenhausstrasse 21, 3300 Amstetten, Austria*
[2]*Institute for Medical Informatics, Statistics and Documentation, Medical University of Graz, Graz General Hospital and University Clinics, Auenbruggerplatz 2, 8036 Graz, Austria*

Abstract

Background: Minimally invasive spine surgery (MIS) is associated with less blood loss, faster recovery, and less perioperative morbidity while yielding similar results as those achieved with open procedures. The risk of peri- and postoperative complications in the elderly and obese patients is a much debated issue. MIS has been poorly investigated in aged and obese patients.

Objective: The aim of the present study is to establish whether MIS techniques are a safe and adequate tool in these patients.

Methods: A retrospective analysis of 33 patients aged 65 years or older, undergoing minimally invasive spinal fusion techniques, in order to identify the risk of peri- and postoperative morbidity in the obese. Obesity was classified according to the body mass index (BMI).

Results: Any harmful event was noted and included in the statistical analysis. The median blood loss and drainage in the postoperative monitoring period was 200 ml. significant differences in blood loss were observed in relation to preoperative administration of NSAIDs. Patients using NSAIDs preoperatively had more frequent (p=0.055) and greater (p= 0.014) blood loss. No difference in blood loss was noted with reference to age or BMI groups. No severe wound healing disorder was observed. We encountered 5 major complications, which consisted of one patient with a neurogenic deficit, one with a transient ischemic attack, one with cardiac ischemia, one with a malpositioned rod, and one with an epidural hematoma. Minor complications included one patient with urinary tract infection, one with respiratory tract infection, and one with fever. No association was observed between complications and obesity.

Conclusion: This study confirms the low soft tissue damage resulting from minimally invasive surgery techniques, which is an important factor in elderly and obese patients. The smaller approach helps to minimize infections and wound healing disorders. Moreover, deeper regions of wounds are clearly visualized with the aid of tubular retractors.

Keywords: Spine; Minimally Invasive lumbar fusion; Older patients; Obesity

Introduction

The life expectancy of the general population has increased significantly in the last few decades. In 2006 the average life expectancy in Austria was 77.1 years for men and 82.6 years for women (Statistical Bureau of Austria). The incidence of degenerative diseases of bone is expected to rise accordingly. Between 1979 and 1992, the rate of surgery for spinal stenosis in patients aged 65 years and older had increased eight-fold in the United States [1]. Despite their advanced age and the occasionally reported complication rates, elderly patients do benefit from spinal surgery and are able to improve their quality of life [2-4].

Besides age, the growing rate of obesity in the population is a frequently discussed problem in surgery [5-8]. Obesity is a common phenomenon in the elderly as well. The largest number of overweight persons is found among the 60- to 74-year-olds (Statistical Bureau of Austria). Studies dealing with minimally invasive fusion techniques in the elderly are scarce [9,10]. To our knowledge, articles concerning the use of Minimally Invasive Spine surgery (MIS) in the elderly and obese do not exist. MIS is believed to provide a smaller corridor to the spine and results in less soft tissue injury. MIS procedures are associated with less blood loss, faster recovery, and less perioperative morbidity while yielding similar results as those achieved with open procedures [11-14]. The purpose of the present study was to evaluate the benefit of minimal-access surgery techniques in the elderly in consideration of their body mass index (BMI).

Material and Methods

After the study had been approved by the local ethics committee, 33 patients older than 65 years of age were recruited for this retrospective investigation. Written informed consent was obtained from all patients and the study was registered under http://www.clinicaltrials.gov ID No. NCT01195584. Lumbar MIS fusion was performed by means of Transforaminal Lumbar Interbody fusion (TLIF) procedures and/or posterolateral fusion alone. In cases of spinal stenosis, a laminotomy was performed.

Obesity was classified according to the body mass index (BMI) established by the WHO. BMI is calculated by dividing the person's mass by the square of his/her height (BMI = kg/m^2). Persons with a BMI<25 are considered to be of normal weight, those with a BMI>25 and <30 overweight, while those with a BMI>30 are considered obese.

***Corresponding author:** Wolfgang Senker, General Hospital Amstetten, Department of Orthopedic Surgery, Krankenhausstrasse 21, 3300 Amstetten, Austria, Tel: +43-7472-604-6611; Fax: +43-7472-604-6609; E-mail: wolfgang.senker@aon.at

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Any harmful event occurring during surgery or postoperatively was noted and included in the statistical analysis.

The number of complications was compared using Fisher's exact Test. If the assumption of normal distributed data was met, continuous variables were analyzed using t-Test or ANOVA. Otherwise non-parametric methods were used. A p-value less than 0.05% was considered significant. Statistical analysis was performed with PASW software version 18.

Surgical technique

Discectomy and laminotomy for spinal stenosis were performed using the Quadrant tubular retractor system (Medtronic Inc., Memphis, TN). After identifying the relevant facet joint by fluoroscopy, an incision was made 1.5 cm off the midline. A tube was inserted subcutaneously and muscle tissue was sequentially dilated by producing a corridor to the facet joint, in a similar fashion as described by Foley and Smith [15]. A tubular retractor was then inserted. The facet joint and the yellow ligament were exposed. The percutaneous fusion system Sextant II or Longitude (both Medtronic Inc., Memphis, TN) was used for posterolateral fusion. In cases of a 360° fusion, i.e. posterolateral and interbody fusion, a TLIF procedure as interbody fusion was performed [16]. In cases of stenosis the retractor was directed to the contralateral side of the spinal canal in order to perform a laminotomy [17].

Results

All of the 33 patients were older than 65 years of age. Their mean age was 73.6 ± 5.5 years. Patients were classified according their BMI. Six patients were of normal weight, 16 were overweight and 11 were obese. Patients of normal weight were younger (69 years) than overweight or obese patients (75 years and 74 years, respectively; p=0.051). All patients were non-smokers. The distribution of genders was similar in the 3 BMI groups. In respect of comorbidities there was no difference between the BMI groups. Approximately two thirds of the patients had hypertension. Similar numbers of patients had hypertension in the BMI groups. Hypothyroidism was found in five cases, coronary heart disease in four, goiter in three, atrial fibrillation, post myocardial infarction and cardiomyopathy in two, and steatosis as well as hepatopathy in one case. Two patients had undergone surgery for discectomy previously.

The mean operating time was 205.5 minutes (range, 82 to 362 minutes). Operating times became longer with advancing age (p=0.009), and were shorter in patients with one widened level (156 minutes) than in those with none, or two or three widened levels (225 and 227 minutes respectively, p=0.025). There was no difference between the BMI groups in respect of operating times (p=0.719).

The mean number of fused segments was 2.5 (range, 1 to 6) and the mean number of cages, 1.9 (range, 0 to 4). There were no differences in respect of the number of fused segments or cages between the BMI groups. Laminotomy for stenosis was performed in 25 patients (75.75%). Of these, 10 patients underwent widening of the spinal canal at one level while 15 underwent widening at two or three levels. The number of widened levels was similar in the three BMI groups.

The median blood loss and drainage in the postoperative monitoring period was 324.6 ml (range 0–1300 ml). Blood loss did not differ in relation to the numbers of widened levels (p=0.931). Significant differences in blood loss were observed in relation to preoperative administration of Non-steroidal Anti-inflammatory Drugs (NSAIDs). Patients using NSAIDs preoperatively had more frequent (p = 0.055) as well as greater (p = 0.014) blood loss (median: 100 ml without NSAIDs and 400 ml with preoperative NSAIDs). We registered no differences in blood loss in relation to age or BMI groups.

No wound healing disorders occurred. One small wound dehiscence and three hematomas were observed. Both of these conditions required no revision surgery.

Leakage of cerebrospinal fluid was noted in 6 patients (18.2%). In cases of a durotomy we tried to close the leakage with 6-0 or 7-0 Prolene (Ethicon NJ). If primary closure could not be achieved we tried to fix the defect with a hemostyptic patch (TABOTAM® Johnson & Johnson Med. Ethicon Biosur NJ) and DuraSeal™ (Confluent Surgical Inc. San Diego, CA). In all cases, an absorbable homeostatic gelatin sponge (SPONGOSTAN, manufactured by Ferrosan A/S, distributed by Johnson & Johnson) and fibrin glue were applied on the corresponding vertebral arch to prevent the formation of cerebrospinal fluid fistulas. Postoperatively we recommended bed rest for 2.5 to 5 days depending on whether primary closure had been performed, and also depending on the size of the defect.

One patient with an epidural hematoma (3%) needed revision on the fourth postoperative day. A further patient required revision because of a malpositioned rod, which had not passed the lowest screw's tulip. One complication was related to osteoporosis. None were unrelated to the surgical technique. Fever was the most common complication in the postoperative period and was observed in 8 patients (24.2%). Of these, 7 had subfebrile temperatures. One patient developed neurogenic deficits, which persisted for a few months. A transient ischemic attack and cardiac ischemia were observed in one patient each. Both were transferred to the proper wards and recovered completely. One patient experienced a urinary tract infection and one a respiratory tract infection (Table 1 and 2).

Discussion

The longer life expectancy of the general population may be expected to raise the incidence of degenerative conditions of the spine. We may therefore anticipate an increase in the number of surgical interventions in the elderly [1,18], including instrumented fusion procedures [19]. Despite the improved quality of life after spinal surgery [2-4], the risk of peri- and postoperative complications in the elderly is a much debated issue [9,10,18,20-23]. Carreon et al. [21] reports a complication rate of 79.59 in 98 patients, aged sixty-five years or above, undergoing decompression and fusion. Twenty-one patients (21%) had at least one major complication, 69 (70%) had at least one minor complication, and 49 (50%) had more than one complication. Ten percent had wound infections. Advanced age and the number of levels fused were identified as risk factors for the development of

Major Complications	Number
Neurogenic Deficits	1 (3%)
Transient Ischemic Attack	1 (3%)
Cardiac Ischemia	1 (3%)
Malpositioned Rod	1 (3%)
Epidural Hematoma	1 (3%)

Table 1: Major complications in urinary tract infection and respiratory tract infection.

Minor Complications	Number
Urinary Tract Infection	1 (3%)
Respiratory Tract Infection	1 (3%)
Fever	1 (3%)
Subfebrile Temperatures	7 (21,2%)

Table 2: Minor complications in urinary tract infection and respiratory tract infection.

complications. Carreon postulated that elderly patients are less able to tolerate major surgery because of their general condition and medical problems. Nevertheless the presence, type, and number of preioperative medical conditions were not related to the prevalence of complications. Benz observed a complication rate of 40% in his patients aged 70 years or older; the rate of serious complications was 12% [20]. Deyo et al. [18] showed, in his review, that operations for conditions other than a herniated disc were associated with more complications and greater use of resources, particularly when arthrodesis was performed. He reported a complication rate of 18% is in patients older than 75 years. Johnsson observed the course of 32 untreated patients with spinal stenosis and recommended no surgical treatment [23]. Rodgers compared MIS XLIF procedures with open Posterior Lumbar interbody Fusion (PLIF) procedures, observing a complication rate of 7.5% in the MIS group and 60% in the open PLIF group [9].

In our patients the most frequent intraoperative complication was leakage of cerebrospinal fluid (18.2%). The yellow ligament has been reported to exert an impact on Accidental Dural Tears (ADT). The aging yellow ligament degenerates and loses its elasticity. During renewed formation of bone, calcium crystals are deposited within the ligament as a sign of ossification [24]. Epstein et al. [25] registered a marked association between these ossified yellow ligaments and ADT. In Epstein's series, an ADT occurred in 31.2% of patients with marked ossified yellow ligaments, and in 9.4% of those in whom an ossified yellow ligament extended to and through the dura. Telfeian et al. [6] reported a durotomy rate of 16.7% for spinal surgery in the morbidly obese. Cole and Jackson [26] performed minimally invasive lumbar discectomies in 32 obese patients and reported incidental durotomies as the most common complication (9.4%). He attributed this to the greater working distance in overweight patients. In contrast, we registered no significant difference in the occurrence of dural tears in our 3 BMI groups. All leakages were closed during the same surgical session as far as possible, and the patients were advised to remain supine for 2.5 to 5 days. Until completion of the present study no patient experienced an adverse consequence due to leakage. Consequently we did not regard ADTs as a complication in the old or obese patient, but an implication of the degeneration of the spine itself, entirely unrelated to the MIS technique.

In concurrence with Carreon et al. [21] we distinguished between major (Table 1) and minor complications (Table 2). A complication that adversely affected the recovery of the patient was considered a major complication, whereas one that was noted in the medical records but did not alter the patient's recovery was considered a minor complication. Revision surgery for major complications was required because of one malpositioned rod and one epidural hematoma (each, 3%). Other major complications included one patient with a neurogenic deficit, which persisted for a few months. A transient ischemic attack and cardiac ischemia were observed in one patient each (each, 3%). One patient came down with a urinary tract infection and one with a respiratory tract infection; both were minor complications (each, 3%). Fever was observed in 8 patients (24.2%). Of these, 7 (21.2%) had subfebrile temperatures. Subfebrile temperatures ranged between 37.5° and 38.0°C, whereas a body temperature above 38.1°C was defined as fever. We registered no statistical difference between the BMI groups concerning peri- or postoperative complications.

The impact of obesity on complications in spinal surgery is not quite clear. However, the fact remains that obesity is a problem of significant magnitude in surgery [5-8,27]. Patel investigated a cohort of 84 patients (60 treated by the open technique and 24 by minimally invasive procedures) and addressed the probability of significant complications related to BMI (p=0.04): the chances of significant complications were 14% in patients with a BMI of 25, 20% in those with a BMI of 30, and 36% in those with a BMI of 40 [5]. Telfeian et al. [6] noted a high complication rate (50%), but good overall outcomes in a small series of morbidly obese patients. Gepstein et al. [7] evaluated 298 patients older than 65 years undergoing decompressive laminectomy, discectomy or a combination of these procedures. He noted that patients with a BMI > 25 had significantly more complications (89 patients with a BMI > 25 versus 33 patients with a BMI ≤ 24.9, p 0.02). Wound infections occurred in 9% of overweight and obese patients. Djurasovic et al. [28] studied 109 obese patients and 161 non-obese patients undergoing single or multilevel lumbar spinal fusion. He registered higher complication rates in the obese group (p = 0.045), principally due to wound-related complications (5.5%).

The fact that we encountered no severe wound healing disorders was attributed to the use of MIS fusion techniques. MIS fusion procedures are associated with less blood loss, faster recovery, and less perioperative morbidity while yielding similar results as those achieved with open procedures [11-13]. The reason for this is presumably the smaller corridor to the spine, which causes less tissue trauma. Enzymes indicative of muscle damage as well as inflammatory cytokines are lower in patients who have undergone mini-open fusion rather than open procedures [29,30].

We registered longer operating times (p=0.009) with advancing age. However there was no difference between the BMI groups.

We registered no differences in blood loss in relation to age or BMI groups. Interestingly, patients who used NSAIDs as painkillers preoperatively had more frequent (p=0.055) and greater blood loss (p=0.014) (median: 100 ml without NSAIDs and 400 ml with preoperative NSAIDs). The role of aspirin as a risk factor for intra- and postoperative bleeding in spinal surgery and spinal regional anesthesia is unclear [31]. Korinth et al. [31] conducted a survey that included 210 neurosurgical facilities: 94 respondents (66.2%) believed that patients taking low-dose aspirin were at higher risk of excessive perioperative hemorrhage, or were undecided about the issue (8.6%) while 73 (51.4%) reported personal experience of such problems. Awad et al. [32] analyzed the records of 14,932 patients who underwent spinal surgery between 1984 and 2002. The use of non-steroidal anti-inflammatory drugs (p=0.048), the Rh-positive blood group (p=0.044), and age above 60 years (p=0.05) placed a patient at a significantly higher risk of postoperative spinal epidural hematoma. These data concur with our findings.

The limitation of the present study is the rather small number of patients, its retrospective design as well as the missing non-MIS control group. Consequently further studies have to be done. Nevertheless, the MIS techniques may have been the reason for the absence of infection in our sample. MIS appears to be advantageous in elderly and obese patients.

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