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Outpatient *vs* Inpatient Lumbar Fusion

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Introduction

Spinal fusion procedures are a cornerstone of modern orthopedic and neurosurgical practices, addressing a range of conditions that necessitate stabilization and relief. Historically, lumbar fusions have been regarded as intensive, as many open procedures involve long incisions and muscle retraction to reach the affected area. As a result, patients required inpatient hospital stays and extended recovery periods. However, due to recent advances in minimally invasive spine surgery techniques, outpatient lumbar fusions are becoming a viable alternative to treat numerous conditions that once mandated open surgery and inpatient hospital stays. Hence, in recent years there has been a growing interest in performing lumbar fusions on an outpatient basis.

The current article will provide a review of the types of lumbar fusions, including Anterior Lumbar Interbody Fusion (ALIF), Posterior Lumbar Interbody Fusion (PLIF), Transforaminal Lumbar Interbody Fusion (TLIF), Lateral Lumbar Interbody Fusion (LLIF), and Posterior Spinal Fusion (PSF) and their appropriateness of being performed in an outpatient setting. We will also provide a retrospective review of lumbar fusion cases performed by a single surgeon, comparing inpatient and outpatient surgeries. Pre-operative factors, such as patient and procedure selection will be considered, as well as a comparison of inpatient and outpatient risk and benefits. Finally, there will be a commentary on the future of selected lumbar fusion procedures in an outpatient setting.

Types of Lumbar Fusions

There are numerous surgical techniques one can choose once a lumbar fusion is deemed as an appropriate next step in management. One such method is the anterior lumbar interbody fusion (ALIF). According to a study performed by Jones et al. [1] that included 3,728 single-level stand-alone ALIFs, 149 procedures (approximately 4.0%) were conducted as outpatient procedures. Of note, when compared to inpatient ALIFs, outpatient ALIFs had a statistically significantly lower incidence of any 30-day adverse event, with 2.0% of outpatients experiencing an adverse event versus 9.2% for inpatient procedures [1]. This finding highlight one of the potential benefits of performing ALIFs as an outpatient lumbar fusion option.

Another lumbar fusion approach, posterior lumbar interbody fusion (PLIF), particularly the open technique, has been studied in an outpatient setting. A study involving 16 consecutive patients demonstrated an overall fusion rate of 87.5% [2,3]. This fusion success was complemented by statistically significant reductions in Visual Analog Scale (VAS) back pain scores and improvements in Oswestry Disability Index (ODI) scores. Furthermore, all patients in this study were discharged the same day, thus supporting the notion that PLIFs can be performed safely in an outpatient setting and that the performance of PLIF in an outpatient setting does not adversely affect patients' reduction in pain symptoms and ODI scores.

Transforaminal lumbar interbody fusion (TLIF) presents an interesting dichotomy between traditional open and minimally invasive approaches. Studies have successfully demonstrated the transition of TLIF procedures to the outpatient setting [2,4,5] showcasing reduced intraoperative blood loss, decreased postoperative pain control requirements, and shorter postoperative lengths of stay [2,6]. However, the context of prior decompression at the same level introduces complexities, such as scar formation and dural adhesions, which can increase the risk of dural tears, potentially complicating the procedure and recovery [2]. Hence, meticulous attention to decompression, disc space preparation, and instrumentation becomes paramount to ensure the safety and feasibility of same-day outpatient discharge. Despite these technical challenges, multiple studies have shown that minimally invasive TLIFs can be performed in an outpatient setting, further broadening the spectrum of lumbar fusion options [2,4,5,7,8,9].

Lateral lumbar interbody Fusion (LLIF) procedures encompass XLIF (extreme lumbar interbody fusion) and DLIF (direct lumbar interbody fusion). Several studies show that outpatient LLIF leads to enhanced patient outcomes, all while maintaining a safety profile similar to that of inpatient interventions [3,10]. This paradigm shift in treatment approach is particularly notable for select patient cohorts, as discussed in the from the predictive study. Factors such as younger age, elevated preoperative hemoglobin levels, a lower number of affected lumbar levels, and a reduced BMI collectively delineate those who stand to benefit most from outpatient interventions employing XLIF and other minimally invasive surgical techniques [8,10]. The clinical study, spanning a cohort of 72 subjects, furnished compelling evidence to support this transition. Importantly, it revealed an absence of intraoperative or postoperative complications in both XLIF and minimally invasive post-fusion cohorts, with no instances necessitating transfers to an inpatient facility [8,10]. These findings again highlight the viability and safety of outpatient LLIFs, emphasizing the need for a diligent patient selection process to maximize its benefits.

In contrast to the approaches discussed above, posterior spinal fusions (PSF) emerge as an outlier. Outpatient posterior spinal fusion, as per data from a national private insurance database, is a relatively uncommon practice in the United States [11]. This database highlights a greater risk of postoperative surgical complications when patients are treated with an outpatient PLIF, such as the need for revision anterior and posterior fusion and decompressive laminectomy. After adjusting for age, gender, and comorbidities, patients undergoing outpatient PSFs were found to have a substantially higher likelihood of requiring revision or extension of posterior fusion, anterior fusion, and decompressive laminectomy within one year. When comparing to the techniques mentioned previously, these findings highlight the risks associated with attempting PSFs as an outpatient procedure, emphasizing the higher reoperation rate when compared to other lumbar fusion methods and adds another preoperative variable that surgeons must consider [11].

The landscape of lumbar fusions comprises various techniques, each with its own set of advantages and considerations. ALIF and minimally invasive TLIF appear to offer promising outcomes in the outpatient setting, while open PLIF demonstrates effectiveness in reducing pain and improving function. Conversely, PSF carries a higher risk of reoperation when performed as an outpatient procedure. These findings stress the importance of carefully considering whether a lumbar fusion should be performed in an outpatient or inpatient settings, with patient-specific factors and surgical expertise playing a critical role in decision-making.

More data on lumbar fusion procedures is further provided by discussing the cases that were performed by Dr. Vivek Mohan at The Orthopaedic Spine Institute. Dr. Mohan's practices show his dedication to using a variety of approaches and customizing procedures to best meet the needs of each patient. Patients ranged in age from 15 to 98-years-old, demonstrating the variety of preoperative factors that are considered to provide comprehensive spinal care for all patients.

Minimally invasive techniques (MIS) were used for the majority of the 145 procedures, demonstrating the growing movement towards less invasive methods. Of the 145 procedures, 90 were inpatient and 55 were outpatient. There is a clear division between inpatient and outpatient procedures, with significant differences in the underlying risk factors. For example, coexisting medical conditions like diabetes, sleep apnea, hypertension, and morbid obesity are common in the inpatient category. Not to be overlooked are psychosocial factors such as bipolar disorder and ADHD. A closer examination of the outpatient cases shows a change in focus toward treating a wider range of patients. Patients with a variety of comorbid conditions, including disc herniations, diabetes, hyperlipidemia, and chronic pain, are undergoing procedures. The rise in the number of outpatient lumbar fusions indicates that patients with a wider variety of medical and psychological conditions are able to undergo outpatient lumbar fusions.

This information highlights the necessity of reviewing patient charts in order to thoroughly identify underlying risk factors. Psychological factors can also be risk factors, as demonstrated by cases of ADHD, anxiety, depression, PTSD, and bipolar disorder. Future challenges will come from finding a balance between the growing diversity of outpatient candidates while maintaining safety and successful outcomes. As the field develops, the data emphasizes how crucial it is to customize protocols to specific patient profiles, use MIS techniques when practical, and iteratively improve guidelines to increase the number of lumbar fusions performed as outpatients. By 2040, outpatient lumbar fusions—along with improvements in tools and surgical methods—will be essential to achieving the potential advantages of outpatient lumbar fusion for a larger group of patients.

Risks and Benefits of Outpatient *vs* Inpatient

It is imperative that healthcare professionals assess individual patient needs and surgical complexity to determine the appropriateness of outpatient spinal surgery. The aforementioned minimally invasive approaches have expanded the scope of potential outpatient candidates and offer the patient various potential benefits. For example, patients who undergo outpatient lumbar fusion may experience faster recovery rates [2]. This is due to the nature of minimally invasive spinal procedures, which offer the patient the potential of experiencing less muscle disruption, decreased blood loss, and decreased risk surgical site infections [12]. In addition to these benefits, studies indicate that outpatient lumbar fusion patients experience similar rates of complication, readmission and functional outcomes to their in-patient counterparts [2]. Thus, increased risks have not been reported when performing a minimally invasive lumbar fusion outpatient procedure over an inpatient procedure for the appropriately selected patient.

The transition from inpatient to outpatient lumbar fusions also exists to offer patients a more cost-effective option. In fact, the significant financial advantages of performing an outpatient lumbar fusion procedure are one of the main factors driving its increased popularity. Moving operations from inpatient to outpatient settings can cut costs by as much as 43% [13]. Furthermore, prominent financial benefits have been noted for a number of lumbar spine procedures, such as short segment fusions, lumbar microdiscectomy, and anterior cervical discectomy and fusions [14] (ACDFs). The total costs for outpatient ACDF, for example, were substantially less than those for inpatient ACDF ($33,362.51 *vs.* $74,667.04), according to a comparative analysis [15]. This means that there could be cost savings of anywhere from $4000 to $8000 [16].

While outpatient lumbar fusion offers various advantages, it is essential to note that these procedures are not devoid of risks, including the potential for infection or the need for readmission to a hospital. However, it has been demonstrated that the incidence of these risks is low and comparable to similar procedures conducted in outpatient settings [6]. Furthermore, any potential risk can be further reduced through the selection of appropriate patient candidates. Thus, balancing the potential benefits of faster recovery and cost reduction with patient safety and proper candidate selection remains a critical factor for the evolving landscape of outpatient spinal fusion procedures.

Factors Affecting Lumbar Fusion

When determining the appropriateness of an outpatient lumbar fusion procedure, numerous factors necessitate consideration. Paramount among these are patient-specific variables, encompassing aspects such as weight and existing medical conditions. While there is no universally agreed-upon set of criteria for determining eligibility for outpatient lumbar fusion, several factors are commonly considered [2]. These factors, outlined by Mohandas et al., include patient-specific considerations such as advanced age (typically over 65 years) and a high body mass index (BMI) exceeding 35 kg/m^2. Additionally, they encompass an increased risk of postoperative complications like nausea and vomiting, lack of functional independence without a reliable caregiver, significant anxiety about surgery in a non-hospital setting even after counseling, chronic opioid use or active substance abuse, and various medical comorbidities such as congestive heart failure, recent myocardial infarction (within 6 months), angina pectoris, heightened thromboembolic risk, obstructive sleep apnea and an American Society of Anesthesiologists (ASA) grade of III or higher [17].

The American Society of Anesthesiologists (ASA) classification system categorizes patients based on their overall health status, with lower grades indicating better health. Patients with ASA classification of I and II are typically considered suitable candidates for outpatient lumbar fusion, given their relatively stable health conditions and lower risk profiles [18]. However, caution is advised when considering patients with ASA III or higher classifications for outpatient procedures, as these individuals may have more complex medical conditions that require closer monitoring and potentially increased postoperative care [19].

Surgeons must weigh these risk factors alongside patient-specific considerations to make informed decisions regarding the appropriateness of outpatient lumbar fusion procedures for individual patients. Furthermore, they must be able to perform procedures efficiently while simultaneously having the ability to understand various patient differences. Complex spinal pathology, particularly deformity cases, presents challenges that may warrant closer postoperative monitoring and support, potentially making outpatient settings less ideal for such cases. Furthermore, surgeons must include considerations such as the potential for increased operative time exceeding approximately two hours and higher surgical invasiveness levels when making the decision to proceed with an outpatient lumbar fusion procedure [17].

Future of Outpatient Lumbar Fusion

The future of outpatient lumbar fusion surgery is expected to be groundbreaking due to the development of new guidelines and the increased focus on affordable and accessible healthcare options. The American Society of Anesthesiologists (ASA) Score, body mass index (BMI), cardiac risk, opioid dependency, and psychosocial factors [20] are all important considerations when deciding between an outpatient and an inpatient lumbar fusion. The selection of the best candidates for outpatient lumbar fusion requires that certain requirements be met, including living within thirty minutes of a hospital, having a body mass index (BMI) of less than 35 kg/m^2, having stable chronic medical conditions, and receiving approval from relevant specialists [3]. These factors are important to consider when evaluating patient suitability for outpatient lumbar fusion procedures, as they can influence surgical outcomes and postoperative care needs.

Anticipating 2040, there are a number of calculated actions that can be performed to increase the rate of outpatient lumbar fusion even more. Procedure efficiency and patient recovery can be greatly enhanced by the incorporation of cutting-edge equipment made expressly to maximize outpatient care. Technological and surgical advances may open the door to more efficient and safe outpatient procedures. It's also critical to address accessibility issues for patients who might not meet the conventional ideal standards. In order to promote inclusivity and advance the acceptance of outpatient surgical approaches in spinal care, creative solutions should be investigated to guarantee that outpatient lumbar fusion becomes a feasible option for a wider range of individuals. The direction that lumbar fusion surgery will take in the future is largely determined by the continuous improvement of guidelines and the search for patient-centered, economically viable approaches.

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