Avoiding Transfusion in 700 consecutive Outpatient Spine Surgery Patients Using Less Exposure Surgery Techniques

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ABSTRACT

Objective: *Spine surgery is transitioning using minimally invasive and less exposure surgery (LES) techniques. Blood loss requiring transfusions remains a distinct complication. The authors aim to demonstrate the use of tips and techniques in decreasing the risk of transfusion in the outpatient setting.*

Methods: *The databases of 1512 outpatient spine cases in a single surgeon study were reviewed between 2011 and 2015. We excluded from our analysis, all cervical and lumbar epidural steroid injections as well as, discograms, rhizotomies and non-spine orthopaedic procedures (total 812).*

Results: *Of a total, of 700 total spine surgery cases, 300 (43%) of all spine surgeries were performed in Group 1 (cervical spine) and 400 (57%) in Group 2 (lumbar spine). Females represented 49% of the overall patient population (Group 1: 146, Group 2: 197). The mean overall age was 49.2 ± 0.8, mean age Group 1 was 50.6 ± 0.9 and Group 2 was 47.1 ± 1.2. Mean overall body mass index (BMI) was 24 ± 0.4, Group 1 mean BMI was 21.0 ± 0.7 and Group 2 BMI was 26.1 ± 0.3. The overall length of surgery was 77.4, Group 1: 65.8 ± 2.1 and Group 2: 89.0 ± 1.5. The mean overall estimated blood loss was 52.4 ± 1.7, Group 1: 43.3 ± 2.4 and Group 2: 55.4 ± 2.1. Blood loss demonstrated significant dependence on length of surgery,* $p < 0.0001$ *with dependence* $R = 0.451$.

Conclusion: *This study has demonstrated using several tips and techniques, reduction of blood loss requiring the need for transfusions. Other factors to consider include patient selection and preoperative preparation for elective spine surgery.*

Keywords: Blood loss, inpatient, less exposure surgery, outpatient, risk reduction, transfusion

Evitar la transfusión en 700 pacientes consecutivos ambulatorios de cirugía de la columna usando técnicas de cirugía de menos exposición

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RESUMEN

Objetivo: *La cirugía de la columna transita al uso de técnicas de cirugía mínimamente invasiva y técnicas de cirugía de menos exposición (CME). La pérdida de sangre que requiere transfusiones sigue siendo una complicación diferente. Los autores persiguen demostrar el uso de consejos y técnicas para disminuir el riesgo de la transfusión en el contexto ambulatorio.*

Métodos: *Se revisaron las bases de datos de 1512 casos de pacientes de columna tratados de manera ambulatoria en un estudio de un solo cirujano, entre 2011 y 2015. Se excluyeron de nuestro análisis, todas las inyecciones esteroides epidurales cervicales y lumbares, así como discogramas, rizotomías, y procedimientos ortopédicos no espinales (total: 812).*

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Resultados: *De un total de 700 casos de cirugía de la columna total, 300 (43%) de todas las cirugías de columna vertebral se realizaron en el Grupo 1 (columna cervical) y 400 (57%) en el Grupo 2 (columna lumbar). Las hembras representaron el 49% de la población general de pacientes (Grupo 1:146, Grupo 2:197). La edad promedio general fue 49.2 ± 0.8, la edad promedio del Grupo 1 fue 50.6 ± 0.9, y la del Grupo 2 fue 47.1 ± 1.2. El índice de masa corporal (IMC) general promedio fue 24 ± 0.4, el IMC promedio del Grupo 1 fue 21.0 ± 0.7, y el IMC del Grupo 2 fue 26.1 ± 0.3. La duración general de la cirugía fue 77.4, Grupo 1: 65.8 ± 2.1, y Grupo 2: 89.0 ± 1.5. La pérdida de sangre general promedio estimada fue 52.4 ± 1.7, Grupo 1: 43.3 ± 2.4, y Grupo 2: 55.4 ± 2.1. La pérdida de sangre demostró una dependencia significativa respecto de la duración de la cirugía,* $p < 0.0001$ *con dependencia* $R = 0.451$.

Conclusión: *Este estudio ha demostrado el uso de varios consejos y técnicas, y de la reducción de las pérdidas de sangre que requieren la necesidad de transfusiones. Otros factores a considerar incluyen la selección del paciente y su preparación preoperatoria para la cirugía electiva de la columna vertebral.*

Palabras claves: pérdida de sangre, intrahospitalario, cirugía de menos exposición, ambulatorio, reducción del riesgo, transfusión

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INTRODUCTION

The risk of blood loss requiring transfusion is a distinct possibility given the complexity of spine surgery procedures (1, 2). Transitioning spine surgery from inpatient to the outpatient setting faces the challenge of minimizing blood loss (3–5). Reducing the amount of blood loss in spinal surgery is a factor that has been demonstrated in the inpatient setting with varying products and techniques studied (6).

Several suggested techniques that reduce blood loss resulting in transfusion include stopping analgesics, supplements and some non-prescription medication two weeks prior to surgery (1). Some techniques to conserve blood are: the use of pre-operative autologous blood donation, appropriate patient's position, adequate muscle paralysis to minimize abdominal infiltration of paraspinal tissue, controlled hypotensive anaesthesia and anti-fibrinolytic agents (2). Techniques in complex spine surgery include, red blood cell augmentation, intra-operative anti-fibrinolytic administration, use of topical haemostatic agents, and intra-operative and post-operative blood salvage (7). General considerations for minimizing blood loss include autologous transfusion therapy, intra-operative and postoperative blood salvage, pharmacologic manipulation of the coagulation cascade and controlled hypotension (8).

Increasing data suggest that surgical blood loss occurs for many reasons including the muscles and bones, bleeding from the exposure of the spine, adult patients with arthritic facet joint and stiffer spines possibly requiring osteotomy (1). Blood products have several possible complications such as impairing the immune system, therefore increasing the infection rate after surgery, coagulopathy or disseminated intravascular coagulation [DIC] (1). The authors aim to demonstrate principles and techniques in reducing the risk of bleeding requiring transfusion in outpatient spine surgery.

SUBJECTS AND METHODS

We reviewed the database of a single spine surgeon in private practice between 2011 and 2015 and identified 1512 procedures performed in the outpatient setting. Procedures also done during this period, which were not considered for this study included, shoulder and knee arthroscopies, carpal tunnel release and lipoma excisions. All appropriate preoperative evaluations were conducted including, history and physical examinations, plain radiographs and magnetic resonance imaging, by the attending spine surgeon. A minimum of at least six weeks of conservative therapy was completed prior to consideration for surgery in all patients. Non-operative therapy included, anti-inflammatory medications, physical therapy, therapeutic steroid injections and, for patients with suspected facet-mediated axial back pain and radiofrequency rhizotomies. All patients were medically cleared by their family practitioners and/or specialists where applicable and regarded fit for surgery by the anaesthesiologists.

Two subgroups were created from all patients who had outpatient surgery, Group 1 (cervical spine) and Group 2 (lumbar spine). Analysis was performed using SPSS v. 22 (IBM Corp., New York, USA).

Exclusions

We excluded from our analysis, all cervical and lumbar epidural steroid injections as well as discograms, rhizotomies and non-spine orthopaedic procedures (total 812), which were considered minimally invasive non-surgical spinal procedures. There were 678 combined outpatient cervical and lumbar procedures remaining.

Inclusions

Inclusion criteria for outpatients was based-on previously published standard (9). Outcome measures evaluated were: age, BMI, length of surgery (LOS), estimated blood loss (EBL),

total transfusions performed and comparison of incidence in single and multilevel procedures

Less exposure surgery strategies

Cervical surgery

- Avoid posterior cervical laminoplasty
- Perform limited laminectomy 1–3 levels combined with anterior discectomy and fusion
- Avoid lateral mass screws
- Use of bone wax

Lumbar surgery

- Avoid dissecting laterally past the pars to avoid pars artery
- Avoid full laminectomy unless severe spinal stenosis
  a. Perform bilateral hemilaminectomies
- Use either cortical bone trajectory, percutaneous screws or facet screws for fusion
- Retain facet joint complex
- Perform lateral fusion under direct visualization
  a. Split muscle fibres bluntly
  b. Perform above L5
  c. Utilize percutaneous screws to provide fixation
- Cauterize epidurals upon identification before bleeding
- Use of bone wax on bleeding bone edges

RESULTS

The study data revealed 700 total spine surgery cases, 300 (43%) of all spine surgeries were performed in Group 1 (cervical spine) and 400 (57%) in Group 2 (lumbar spine). Females represented 49% of the overall patient population (Group 1: 146, Group 2: 197). The mean overall age was 49.2 ± 0.8, mean age group 1 was 50.6 ± 0.9 and Group 2 was 47.1 ± 1.2. Mean overall BMI was 24 ± 0.4, Group 1 mean BMI was 21.0 ± 0.7 and Group 2 BMI was 26.1 ± 0.3. Demographics are illustrated in Table 1.

Table 1: Demographic data of sample population

Variable	Total	Cervical spine	Lumbar spine
Surgeries	700	300	400
Male	357	154	203
Female	343	146	197
Single level	477	181	296
Multilevel	233	119	104
	Mean		
Age (years)	49.2	50.6	47.1
BMI (kg/m^2)	24.0	21.0	26.1
LOS (mins)	77.4	65.8	89
EBL (mLs)	52.4	43.3	55.4

BMI: body mass index; LOS: length of surgery; EBL:estimated blood loss

There were 244 cervical fusion and 56 cervical discectomy with annuloplasty performed in Group 1. In Group 2, there were a total of 133 fusions, 106 decompressions and interspinous fixations and 161 decompressions. Procedures performed are demonstrated in Table 2 and show overall fusions were significantly more than decompressions, $p < 0.001$. Decompressions with interspinous fixation and discectomies were considered as decompressions.

Table 2. Demographic data of surgeries performed by level and type of surgery

Surgeries	Total (n)	Cervical spine	Lumbar spine
Single level	477	181	296
Fusion	224	133	91
Decompression	253	48	205
Multilevel*	223	119	104
Fusion	153	111	42
Decompression	70	8	62

The overall length of surgery was 77.4, group 1: 65.8 ± 2.1 and Group 2: 89.0 ± 1.5. The mean overall estimated blood loss was 52.4 ± 1.7, Group 1: 43.3 ± 2.4 and Group 2: 55.4 ± 2.1. Further analysis to determine if blood loss was dependent on length of surgery, demonstrated significance, $p < 0.0001$ with dependence R = 0.451.

The use of haemostatic agents was employed in all lumbar cases; however, this was not necessary in cervical cases. There were no blood transfusions or use of haemopoetic agents intra-operatively or postoperatively.

DISCUSSION

The aim of this study is to report on two groups of patients, who demonstrate the use of several surgical tips and techniques in decreasing blood loss thereby decreasing the risk of blood transfusion in elective outpatient spine surgery cases. In this study, a total of 700 outpatient spine cases were performed without the necessity to transfuse patients with blood in the peri-operative or postoperative periods. There was a statistically significant correlation between length of surgery and estimated blood loss, $p < 0.0001$.

Elective surgery has demonstrated a change in management techniques over recent years (10). These changes include, improved patient selection, pre-operative workup, anaesthesia and surgical techniques (2–4, 7, 10–12). The move towards ambulatory outpatient surgery has been driven by the factors of cost to patient, improved outcomes and decreased recovery time to normal function (3, 5). Blood loss is a major factor in surgical recovery with large volume blood losses increasing chances of transfusion and admission for observation (1, 11, 13).

The impetus on spine surgeons to transition to the outpatient setting has been spurred by minimally invasive and less exposure surgery techniques (4, 9, 11, 14). Several studies have demonstrated the use of transexemic acid, bipolar sealer devices in reducing blood loss and transfusion requirement in surgery for scoliosis (15, 16). Other outpatient studies are available demonstrating surgical techniques with excellent or equivocal outcomes to inpatient surgery, with comparison of blood loss (3–5). However, few studies directly assess factors and techniques to reduce blood loss in spine surgery (11–13). The authors note several strengths and limitations to this

study. Major strengths include that all surgeries were performed as outpatient cases in multiple centres. The total number of patients is adequate but no previous studies were found to conduct *a priori* power of analysis. This paper also adds to the volume of information available for outpatient spine surgery and risk-reduction in transfusion requirements. Limitation include, all cases were by a single surgeon who had prior experience in the inpatient setting and a single arm study design.

CONCLUSION

Advances in surgical techniques with the advent of less exposure surgery and minimally invasive spine surgery have demonstrated the need to reduce complications of blood loss requiring transfusion. This study has demonstrated the risk-reduction for outpatient spine surgery using patient selection and improved surgical techniques.

AUTHORS' NOTE

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