



Original Contribution

Spinal versus general anesthesia for lumbar spine surgery in high risk patients: Perioperative hemodynamic stability, complications and costs



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ABSTRACT

Objective: More stable perioperative hemodynamic conditions, lower costs and a lower perioperative complication rate were reported in young healthy patients undergoing lumbar spine surgery in spinal anesthesia (SA) compared to general anesthesia (GA). However, the benefits of SA in high risk patients (ASA \geq II suffering from cardiovascular and/or pulmonary pathologies) undergoing this surgery are unclear. Our objective was to analyze whether SA leads to an improved perioperative hemodynamic stability and to a more cost-effective management compared to GA in high risk patients undergoing this surgery.

Methods: In a retrospective analysis 146 ASA II–III patients who underwent lumbar spine surgery in SA were compared with 292 ASA I–III patients who were operated in GA between 2000 and 2014. Hemodynamic effects, hospitalization times, complications, and costs according to the Swiss billing system were assessed. The data extraction was conducted according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative for cohort studies.

Results: The patients in the SA group were older (75 years (± 9.6) vs 69 (± 11.5), $p < 0.001$), had a lower BMI (25.8 kg/m² (± 4.8) vs 27.2 (± 4.7), $p = 0.003$) and showed a higher ASA score (3 vs 2, $p < 0.001$). However, SA was associated with significantly better perioperative hemodynamic stability with less need for intraoperative vasopressors (15% vs 57%, $p < 0.001$), volume supplementation (1113 ml ± 458 vs 1589 ± 644 , $p < 0.001$) and transfusions (0% vs 4%, $p < 0.001$). Additionally, the number of hypotension episodes was lower in the SA group (15% vs 47%, $p < 0.001$). Furthermore, the SA group showed a significantly shorter duration of surgery (70 min (± 1.2) vs 91 (± 41), $p < 0.001$), lower postoperative nausea and vomiting (PONV) (4% vs 28%, $p < 0.001$) and pain in the post anesthesia care unit (PACU) (visual analogue scale (VAS) 2.3 (± 1.1) vs 0.8 (± 0.8), $p < 0.001$), whereas pain after 24 h did not differ (VAS 0.9 (± 1) vs 0.8 (± 1.1), $p = ns$). The postoperative complication (7% vs 5%, $p = 0.286$) and revision rates (4% vs 5%, $p = 0.626$) were similar in both groups. Total costs (United States Dollars (USD) 6377 (± 2332) vs 7018 (± 4056), $p = 0.003$) and PACU time were significantly lower in the SA group (35 min (± 12) vs 109 (± 173), $p < 0.001$).

Conclusions: Lumbar spine surgery in cardiovascular high risk patients with SA is safe, allows good perioperative hemodynamic stability and might lead to lower health care costs. Further prospective studies are needed to confirm these findings.

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1. Introduction

The increasing proportion of elderly patients and their comorbidities [35] have modified the perioperative risk profile and perioperative hemodynamic and cardio-pulmonary stability have become of pivotal importance [13]. Spinal anesthesia for lumbar spine surgery has been associated with a greater hemodynamic stability compared to general anesthesia [18]. However, these findings are controversially discussed by other authors [29]. Additionally, the increasing economical restraints force hospitals to increase their productivity by lowering procedure-

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specific costs and avoiding complications [31,37]. Regional anesthesia has been shown to reduce perioperative costs by reducing drug consumption, decreasing or bypassing PACU stay and allowing earlier ambulation. [30,32,33,44] Furthermore, multiple studies have shown that spinal anesthesia might lead to a reduction in analgesic use, shorter anesthesia and surgery time, reduced blood loss, less PONV, a lower complication rate and reduced costs [1,5,17,18,22,29,36,41,42]. However, some possible drawbacks of spinal anesthesia like longer PACU stay and lower surgeon satisfaction have also been reported [18,22].

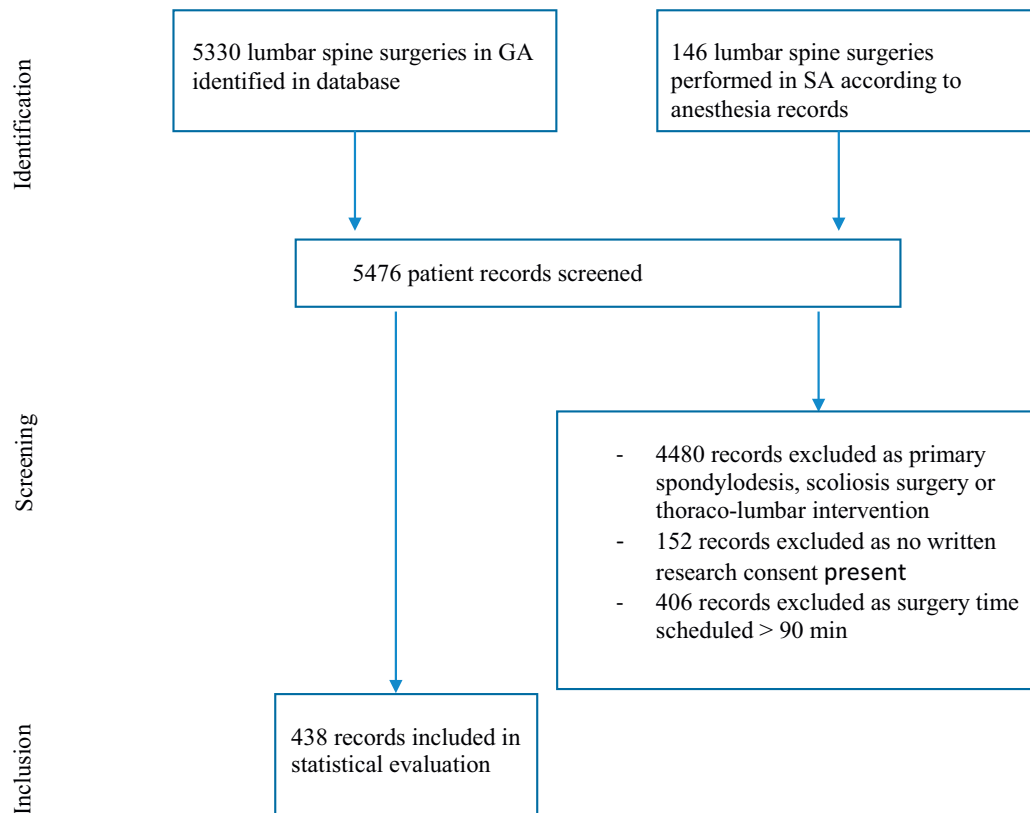
To our knowledge, the impact of spinal anesthesia for lumbar spine surgery on hemodynamic stability and costs has not been analyzed in high risk patients [11]. The aim of this retrospective study was to analyze these outcomes comparing a cardiovascular or pulmonary high risk (ASA \geq II suffering from cardiovascular and/or pulmonary pathologies) population which in our institution is usually operated in spinal anesthesia with a relatively low risk population usually operated in general anesthesia for lumbar spine surgery.

2. Methods

After approval by the Ethical Committee (Kantonale Ethikkommission des Kantons Zürich, EK: 2015-0526) we retrospectively analyzed the medical charts of all patients undergoing lumbar spine surgery in the period 01.01.2000 – 31.12.2014. To avoid selection bias we checked all patients with lumbar spine surgery during this period and extracted 146 patients who underwent surgery with spinal anesthesia (SA). We compared these patients to a group of 292 patients operated in the same time period in general anesthesia (GA) (Fig. 1).

The data extraction was conducted according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative for cohort studies. Our inclusion criteria were adult patients of both sexes undergoing elective lumbar spine surgery of a duration of <90 min. For the SA group this surgery was performed in spinal anesthesia due to a cardiovascular and/or pulmonary high risk situation (ASA II-IV). General anesthesia was performed for any ASA category (ASA I-III). Exclusion criterion was the written patient refusal to use her/his records for research. Our primary outcome was the hemodynamic stability (hypotension episodes, intraoperative vasopressor/volume use). Additionally, we compared costs, perioperative anesthetic/surgical complications, blood loss, pain (at PACU arrival and at 24 h), length of PACU stay, length of hospitalization and the revision rate. All surgeries were performed by a spine fellow or a staff surgeon and all data were collected, collated and analyzed by four independent researchers.

After intravascular access and standard monitoring (electrocardiography, non-invasive blood pressure monitoring and peripheral oxygen saturation monitoring) spinal anesthesia was performed in the lateral decubitus position using plain bupivacaine 0.5% (5–10 mg) with immediate positioning first into the supine position until a sensory level between T6 to T8 was achieved. Then, patients were turned into the prone, flat position. Oxygen administration was provided by nasal cannula at a flow of 2 l/min. Mild to moderate sedation defined according to Standards, Guidelines and Statements of the American Society of Anesthesiologists [4] was performed using a propofol and remifentanyl targeted-controlled infusion (TCI). Sedation depth was monitored using the modified Observer's Assessment of alertness/sedation scale



GA = general anesthesia; SA = spinal anesthesia

Fig. 1. Flowchart according to the STROBE guidelines.

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