SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Surgery

The Impact of Epidural Anaesthesia and Analgesia on Patient-Centered Outcomes Following Open Prostatectomy for Benign Prostatic Hyperplasia

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DOI: https://doi.org/10.36347/sasjs.2025.v11i09.009 | **Received:** 15.07.2025 | **Accepted:** 19.09.2025 | **Published:** 25.09.2025

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Abstract | **Original Research Article**

Evidence from studies indicate that epidural anesthesia and analgesia (EAA) improves post operative recovery and outcomes following open retropubic radical prostatectomy for organ confined prostate cancer. Literature is sparse on such improvements following open prostatectomy for benign prostatic hyperplasia (BPH). This study aims to fill that gap. ***Methods****:* A prospective study of patients who had open prostatectomy for (BPH) under EAA (Group A) and those who had other forms of anesthesia (Group B) between January 2017 and December 2023 in the Urology department of a tertiary hospital was undertaken. Immediate postoperative outcome data recorded for each patient were number of pints of blood transfused, total irrigation fluid volume, pain scores, bladder spasms count, episodes of blocked catheters, and weight of prostatic adenoma enucleated. ***Results:*** There were 46 patients divided into 25 and 21 for groups A and B respectively. Post operative blood loss, as estimated by average number of pints of blood transfused and total volume of irrigation fluid was significantly higher for group B than A patients (3.05 ± 1.28 vs 0.92 ± 0.86 pints and 51.74 ± 15.72 vs 24.96 ± 5.74 liters respectively; P<0.001). Episodes of blocked catheter and bladder spasms were also significantly lower for group A than B patients(P<0.001). Expectedly, post operative pain scores was higher for group B patients (5.19 ± 1.34 vs 1.44 ± 1.00 for group A; p<0.001). Average weight of enucleated adenoma for both groups was 107.8 ± 55.4 and 132.1 ± 69.2 respectively (P=0.192). ***Conclusion:*** Post operative epidural analgesia significantly reduced the pain, the spasm, the bleed, the block and flush, commonly associated with open prostatectomy for BPH in the immediate postoperative period.

Keywords: Epidural anesthesia and analgesia, Open Prostatectomy, Benign Prostatic Hyperplasia, Patient-centered outcomes, bladder spasms.

INTRODUCTION

Epidural anesthesia and analgesia (EAA) is regarded as the use of epidural anesthesia intraoperatively followed by epidural analgesia in the post operative period [1]. Evidence from several studies supports the hypothesis that EAA improves surgical outcomes due to its inhibitory effect on metabolic and endocrine responses to surgery [2-4]. There are three domains of surgical outcomes namely: mortality, major morbidity and patient centered outcomes. Of these, there is a consensus on the positive impact of EAA on patient centered outcomes, specifically, satisfaction, quality of recovery and superior analgesia [5,6]. On the other two domains, results from studies are varied and inconclusive except in high-risk surgical patients undergoing major surgery [5-7]. Furthermore, data exists on benefits of EAA following open radical retropubic prostatectomy (RRP) for localized prostate cancer such as reduced perioperative blood loss, lower perioperative demand for fluid and catecholamines, faster processing times, shorter hospital stay, reduced cancer progression and improved overall survival [8-10]. Whereas, studies assessing the benefits of EAA following Open Prostatectomy (OP) for Benign Prostatic Hyperplasia (BPH) is lacking. Edomwonji *et al.,* in their espousal of regional anesthesia for OP noted advantages such as good urinary drainage begetting reduction in the risk of blocked catheters, decreased incidence of deep vein thrombosis (DVT), and decreased amount of blood loss during the procedure [11]. The introduction into practice of minimally invasive treatments (MITs e.g. TURP, HoLEP) for BPH has led to a decline in the need for open prostatectomy in the developed world. However, in the developing world, adeptness in the procedure is indispensable, in the face of paucity of endoscopic equipment and trained

manpower as well as late presentation by patients and the attendant complications [12]. Nevertheless, the indications for OP remains and is universal, irrespective of the clime. These include large prostate adenomas, bleeding prostates, concomitant bladder pathologies (diverticula, stones), inguinal hernias and ankylotic hip joints which rules out the lithotomy position for TURP [12-14]. OP is acclaimed for long-lasting outcomes and low re-operative rates when compared with MITs [13,14]. It should be retained as a true alternative to endourological techniques, and incorporated into modern urology training programs [15]. One major complication of OP is post operative bleeding and literature is replete with techniques described to attenuate this and make the procedure safer [16,17]. The focus here is the immediate postoperative period during which effective management is crucial for successful outcome. This study aims to assess the impact of EAA on patient centered parameters commonly encountered following open prostatectomy for benign prostates.

Patients and Methods

A prospective observational study involving all patients who had open prostatectomy (Transvesical prostatectomy, TVP) for BPH in the Urology Unit of the University of Uyo Teaching Hospital between January 2017 and December 2023 was undertaken. Institutional ethical review board approval was obtained and we proceeded to focus on type of anesthesia administered (Combined Spinal and Epidural, CSE, only; CSE plus post operative epidural analgesia; subarachnoid block or endotracheal GA), and immediate postoperative outcomes such as number of pints of blood transfused, number of liters of normal saline used for bladder irrigation, pain scores using numeric rating scale (NRS), number of bladder spasms (BS) experienced by patients per day in the first 72 hours postop and number of times urethral catheter got blocked and required flushing. By bladder spasm is meant the 'contracting, painful desire' to micturate, accompanied by peri-catheter leakage, associated with an indwelling urethral catheter. Other data such as demographics and weight of adenoma enucleated were entered into study proforma, for each patient. The independent samples t-test of IBM SPSS version 25 software was employed in data analysis which statistical significance was set at $P<0.05$.

Combined spinal and epidural anesthesia followed by postop epidural analgesia for OP was introduced into our practice by one of the authors and since then it's been the preferred method. Occasionally, when expertise and materials are unavailable, or contraindications preclude its use, there is a resort to other methods. This formed the basis for stratification of the patients into two arms- Group A being those that had their surgery done under CSE PLUS post op epidural analgesia (EAA) while Group B were those who had NO postop epidural analgesia. Technically, for CSE, the epidural catheter is first inserted via the L2/L3 or L3/L4 interspace into the epidural space using loss of resistance to air method. Epidural test dose will be administered using 3mls of 2% lidocaine and adrenaline. Next, the spinal block is established via the L4/L5 interspace using 0.5% (2.5-3.0 ml) heavy bupivacaine ± adjuvant opioids (fentanyl, tramadol) or alpha 2 adrenoceptor agonist (dexmedetomidine). Intraoperatively, epidural anaesthesia is activated using a loading dose of 0.5% plain bupivacaine given in aliquots, not exceeding 10-15mls depending on the safe dose of the individual patients and target blockade. Maintenance top-up is done using 5mls of 0.25% of plain hyperbaric bupivacaine. For postoperative analgesia, a cocktail consisting of 0.125% plain bupivacaine and 0.1mg/ml morphine (or 25mg/ml pethidine if patient has morphine allergy) is given via the epidural catheter as 5mls intermittent boluses at 4-6 hourly intervals for 72 hours. Additionally, 100mg rectal diclofenac is given 12-hourly for 72 hours as part of a multi-modal analgesic regimen. No intravenous opioid analgesics are given during this period. Postoperatively, the bladder is irrigated via a three-way FG 22 urethral catheter (foley's, the balloon lodged in the prostatic fossa and inflated with 30-50ml saline), to prevent clot retention. Postop pain management for group B patients usually consists of intravenous opioids and rectal diclofenac for the first 72 hours, while bladder irrigation requires an additional insertion of a suprapubic catheter.

Results

There were 46 male patients with age range 52-88 years (mean 66.7 ± 8.8). 25 of them (group A) had their surgery carried out under CSE and postop epidural analgesia with mean age of 65.76 ± 9.60, while 21 of them (group B, had either CSE or spinal only or endotracheal anesthesia without postop epidural analgesia), with mean age 67.81 ± 7.96 ($P= 0.441$). Postoperative blood transfusion was lower for group A (0.92 ± 0.86 pints) than for group B patients (3.05 ± 1.28 pints), $P<0.001$. Volume of normal saline used for bladder irrigation to prevent clot retention was equally lower for group A (24.96 ± 5.74 liters) than for group B (51.74 ± 15.72 liters), $P<0.001$. Pain scores for groups A and B were 1.44 ± 1.00 and 5.19 ± 1.34 respectively ($P<0.001$). The number of times patients experienced bladder spasms was almost non-existent for group A compared to group B patients (0.36 ± 0.91 vs 10.24 ± 5.75). There were almost no reports of catheter blockages needing flushing with group A patients who had postoperative epidural analgesia when compared to group B who had other forms of postoperative analgesia (0.20 ± 0.41 vs 1.38 ± 1.69, $P<0.05$). The weight of adenoma for both groups were not significantly different at 107.80 ± 55.41 vs 132.14 ± 69.22 ($P=0.192$) respectively. Table 1 summarizes the findings.

Table 1: Summary Statistics of Outcomes

Group	Average Number of Pints Transfused	Average Total Volume of Irrigation (Litres)	Average Pain Scores	Average Number of Bladder Spasms	Average Number of Times Catheter Blocked	Average Weight of Adenoma (Grams)
A	0.92 ± 0.86	24.96 ± 5.74	1.44 ± 1.00	0.36 ± 0.91	0.20 ± 0.41	107.8 ± 55.4
B	3.05 ± 1.28	51.74 ± 15.72	5.19 ± 1.34	10.24 ± 5.75	1.38 ± 1.69	132.1 ± 69.2
P value	0.000	0.000	0.000	0.000	0.001	0.192
95% C. I.	-2.77 to - 1.49	-33.59 to – 19.97	-4.44 to - 3.06	-12.23 to -7.53	-1.88 to -0.48	-61.4 to – 12.7

Group A- Surgery using Combined Spinal & Epidural (CSE), and Postop Epidural Analgesia
Group B- Surgery using CSE, GA, Subarachnoid block, and Postop Parenteral Analgesia

DISCUSSION

The positive impact and limitations of EAA on surgical outcomes is well researched and documented in the medical literature. The outcomes domain, namely mortality, morbidity and patient-centeredness have been focal in this assessment. For the first two, results have been disparate as some studies demonstrate benefits while others do not. However, on patient-centered outcomes, there's uniformity in the results with significant advantages. Obtaining a validated outcome-measure instrument is characterized by continuous revision, largely due to either organ- or specialty-based outcome reporting in clinical studies [18]. The recently introduced standardized endpoints in perioperative medicine (StEP), and its updated, validated, 8-point format, such as supplementary analgesic use, subjective analgesic effectiveness, pain intensity, incidence of postoperative nausea and vomiting (PONV), post discharge nausea and vomiting (PDNV), severe PONV, quality of recovery (QoR-15) and time to mobilization; is regarded as a general tool-kit meant to streamline outcome reporting [19]. It does not address certain outcomes peculiar to open prostatectomy for BPH, as highlighted by the PROSPECT (procedure -specific postoperative pain management) study after open liver resection [18]. Thus, in this study the pain and blood loss endpoints were adopted while the prostatectomy-specific ones such as volume of saline required for irrigation, bladder spasms and catheter blockage counts were added.

Bleeding complication is a recognized peril associated with open prostatectomy for BPH in the perioperative period [12,13,16]. In this study, the attenuating effect of postoperative epidural analgesia on bleeding was apparent. Comparing the figures, 0.92 ± 0.86 vs 3.05 ± 1.28 (P< 0.001), which represents the average number of pints of blood transfused postoperatively for the groups with and without postop epidural analgesia respectively, is indicative of less blood loss in the former group. Closely related to this is the volume of irrigating fluid required to prevent clot retention which was significantly lower in the group that had postop epidural analgesia (24.96 ± 5.74 vs 51.74 ± 15.72 liters, P<0.001). Evidently, there is a correlation between the volume of fluid required for irrigation and the degree of bleeding. Neuraxial blockade (epidural or spinal block at spinal cord level) produces sympathetic afferent nervous paralysis resulting in hypotension, short-circuiting of blood flow from the operation site and decreased blood loss [3,17]. Our finding is congruent with other studies that have demonstrated the blood-loss attrition potential of EAA [2,3]. Frank *et al.,* [8] reported significantly less blood loss and replacement in patients who had postop epidural analgesia following radical retropubic prostatectomy compared with the postop systemic analgesia group. Similarly, Kofler *et al.,* [9] found reduced perioperative blood loss, reduced volume and catecholamine needs in their CSE group for same procedure. Studies investigating impact of postoperative epidural analgesia on outcomes following OP for BPH is notably lacking. To the best of our knowledge, ours is the first to address this subject in the literature.

A foremost patient-centered outcome domain is the pain domain. Our data on pain scores in the two groups of patients (1.44 ± 1.00 vs 5.19 ± 1.34, P< 0.001) clearly depicts significantly lower pain scores in the EAA arm as against the intravenous analgesia with opioids arm. Our result is in conformity with findings reported in various studies, showcasing the superior analgesic effect of EAA [1-9]. Pain and surgery are inextricable: About 75% of patients who have surgery experience acute pain while less than 50% report adequate pain relief in the postoperative period [20,21]. Consequently, the efficacy, quality and efficiency of perioperative care is encapsulated in 'adequate pain relief' which promotes patient comfort and well-being, and engenders confidence in the managing team. Patients have advocated that pain relief is key to fostering comfort and a sense of well-being [19]. Wu *et al.,* [5] noted a correlation between severity of pain in the postoperative period and decrease in quality of recovery (QoR).

An outstanding finding in this study was the near-elimination of bladder spasms' count in the postop epidural group (see Table 1), making it one of the most significant impact of EAA on patient-centered outcome in this study. BS is an involuntary, intermittent and distressing painful experience in the abdomen

occasionally accompanied by sweating and peri-catheter urine leakage. Also described as a severe contracting painful desire to micturate, occurring in patients who have had prostate, bladder or lower urinary tract surgery, and require urethral catheter bladder drainage in the postoperative period [22]. The parasympathetic efferent neuronal supply arises from the sacral cord, traverses the pelvic and pudendal nerves and exerts an excitatory (contracting) effect on the urinary bladder, and an inhibitory (relaxing) effect on the urethra. In contrast, the afferent neural sympathetic transmissions relayed via the hypogastric and pelvic nerves to the lumbar cord exert inhibitory and excitatory activities on the urinary bladder and urethra respectively [23]. Both responses are usually blocked by epidural analgesia utilizing bupivacaine and opiates. This makes it the most effective method of inducing temporary paralysis of the bladder-urethral complex in dimensions unachievable with intravenous patient-controlled analgesia (IV-PCA) with opioids [24]. Studies in this field is scarce, however, the paralyzing effect of epidural obstetric analgesia on the urinary bladder causing retention is widely reported [25]. Chiang *et al.,* [26] reported better control of postoperative bladder spasms in children with intravesical bupivacaine, whereas epidural analgesia was most effective for pain treatment. Additionally, Ladjevic N. *et al.,* [17] noted superiority of lumbar epidural analgesia over its thoracic counterpart in inhibiting urinary bladder function. Data from a large study that utilized multiple study designs demonstrated superiority of epidural analgesia over parenteral opioids in the first 72 hours postoperatively [5]. Similarly, our results reflect adequacy of epidural analgesia within the stated period, and should be adopted as standard duration for postop epidural analgesia.

Catheter blockages by tiny blood clots was rarely reported in our epidural analgesia arm relative to the B arm. Bladder spasms, from our observation, induces bleeding from the prostatic bed which in turn increases frequency of catheter blockage. Edomwonji *et al.,* [10], similarly reported a reduction in risk of catheter blockage with epidural analgesia facilitating good urinary drainage.

The cumulative effect of reduced blood loss, reduced pain, little or absent spasms, decrease incidents of catheter blockage and the attendant need to flush, makes open prostatectomy using epidural anesthesia analgesia an attractive option for surgical management of benign prostatic hyperplasia. A major consideration in outcomes is cost of recovery with emphasis on decreasing hospital stay and re-operation rates [13,14]. With less blood transfusion and use of irrigation fluids coupled with zero reoperation rate adds up to significant cost reduction in our study.

The impact of EAA on mortality outcome has shown mixed results. Our series recorded zero mortality. This is consistent with findings from a recent study by Abbasi *et al.,* [27] that demonstrated a reduced 30-day morbidity and mortality in 110 patients; and with results from previous studies [5, 28]. Most recent studies have, however, not demonstrated any benefit attributable to EAA on the mortality domain. This is traceable, partly, to the service-wide departure in favour of MITs and the decline in need for EAA [18,19]. In the setting of major open thoracoabdominal surgery, to which open prostatectomy belongs, EAA carves for itself an indisputable niche [18].

The physiologic benefits of EAA stems from its potential to vitiate the neurohumoral and immunologic stress response to surgery resulting in less cardiac, pulmonary, gastrointestinal and vascular complications [29]. An aging urological patient population negatively influenced by social media, is predictive of late presentations with large adenomas and complications such as stones, bleeding and bladder diverticulum. The concomitant comorbidities (hypertensive heart disease, diabetes, chronic obstructive airway disease, etc.) prevalent in them makes major open surgery risky. EAA with its established benefits becomes a vital tool for successful surgical intervention in these patients. Results of this study and the foregoing narrative, corresponds with the position held by the American Pain Society which recommends, "routine use of epidural or spinal analgesia for management of postoperative pain in patients who undergo major thoracic and abdominal procedures, caesarean section, and hip and lower extremity surgeries, particularly in patients at risk for cardiac and pulmonary complications or prolonged ileus [21]." Epidural block is not without disadvantages. Arguments against its use is premised on two potential complications which are stated to be rare as follows: transient paresthesia (occurs in <10% of patients) and epidural hematoma (occurs in 0.0006% of cases) [2]. Our data, confirming their rarity, recorded no such events.

This study is limited by the small number of subjects. However, pioneering evidence has been established, that EAA improves patient centered outcomes following open prostatectomy for BPH making recovery comfortable and the procedure safer for patients. Further studies could be carried out on a larger scale to confirm these findings.

CONCLUSION

Epidural anesthesia and analgesia vitiate the neuroendocrine stress response to open prostatectomy for benign prostatic hyperplasia. The impact was marked on patient centered outcomes of comfort, quality of recovery and superior analgesia. This reflected in less need for blood transfusion and irrigation fluids occasioned by less blood loss, significantly reduced pain scores, abolishing of distressing bladder spasms. Urethral catheter drainage was greatly enhanced by elimination of blockages and attendant intermittent flushing. These impacts, when viewed against the backdrop of an aging patient population with associated

co-morbidities, makes EAA the anesthetic technique of choice for open prostatectomy.

Conflict of Interest: The authors declare non-existence of conflict of interests.

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