**SURGEON SATISFACTION WITH FLEXIBLE URETERORENOSCOPY AND LASER LITHOTRIPSY: A COMPARISON BETWEEN GENERAL ANAESTHESIA AND COMBINED-SPINAL ANAESTHESIA.**

***ABSTRACT***

***Introduction***

***Aim****-To compare the effect of* *General Anaesthesia (GA) and* *combined Spinal Epidural Anaesthesia (CSE) on flexible Ureterorenoscopy outcomes and surgeon comfort.*

***Materials and method****- The study was conducted in 2 years, in a randomized prospective pattern. Sample size was 34, GA group (n=17) and CSE group (n=17). Demographic, operative and post-operative parameters of patients were analysed.*

***Results:*** *The study included 34 randomized patients with ASA I and II, no difference in demographic variable. Monitoring vital signs intraoperatively, 3 patients in CSE group experienced bradycardia, and hypotension which was significant when compared with GA group, bradycardia (p=0.002), hypotension (p=0.001). Additionally, 1 patient in CSE group experienced mucosal tears, but no complications were observed in the GA group (p=0.006) statistically significant. Postoperative surgeon comfort evaluation revealed statistical significance in favour of the GA group (p=0.001).*

***Conclusion:*** *Although regional anaesthesia may be preferred by the Anaesthesiologist, to avoid polypharmacy, and airway manipulation, both GA and CSE are equally effective and safe Anaesthesia methods for f-URS procedures. However, CSE group showed statistical significance in bradycardia and mucosal injury and decreased surgeon comfort during surgery.*

***Keyword:*** *laser lithotripsy, general anaesthesia, combined spinal epidural anaesthesia.*

**INTRODUCTION**

Urolithiasis is a highly prevalent urological disease that significantly impacts the health and quality of life of affected individuals.1 The prevalence of the disease varies across different regions in the world, ranging from 0.1 to 14.8% in Western countries to up to 10.6% in the Asian population.1,2 Flexible ureterorenoscopy (f-URS) is the state of art, and accepted as an important approach in the management of renal stones because of its reasonable success and lower complication rates 3 because of the advanced technology and modern procedural equipment.4 There has been an extensive examination of factors affecting f-URS success, such as stone volume, stone location, stone number and surgeon experience, however; effect of Anaesthesia type has not been evaluated sufficiently.5,6 In ureterorenoscopy, anaesthetists prefer regional anaesthesia to general anaesthesia to avoid complications due to general anaesthesia4 while surgeons prefer general anaesthesia to avoid urethral trauma.7 Control of anaesthesia duration, effective control of patient’s respiratory movements and high patient’s compliance are the advantages of the GA during RRS.8,9 Aspiration of gastric contents, adverse drug events and cardiopulmonary complications are more common in patients undergoing GA.10 On the other hand, risk of venous embolism and bleeding are lower in patients undergoing RA.11 Although it has be demonstrated by Sahan et al10 that Both GA and RA are equally effective and safe anaesthesia methods for f-URS procedures but , RA group showed significantly increased likelihood of bradycardia and mucosal injury during surgery, and significantly decreased surgeon comfort during surgery, there are no studies reported in our environment. Therefore, this study is designed to compare the effect of general anaesthesia (GA) and combined spinal epidural on f-URS, outcomes and surgeon comfort.

**MATERIALS AND METHODS**

The study was conducted in 2years, and data collection was in a randomized prospective, pattern. Ethical committee approval and patient’s written informed consents were obtained. Patients with renal stone between 18 to 60 years of age, with American Society of Anaesthesiologists (ASA) physical status score of I and II were included in the study. Exclusion criteria were history of cardiac, respiratory, neuromuscular disease, pregnancy, congenital renal anomalies, contraindications of regional or general anaesthesia such as local skin infection, vertebral deformity, and neuropathy. After inclusion and exclusion criteria were applied, 34 patients participated in the study. Before the induction of anaesthesia, a coin was flipped accompanied by surgical nurse and heads were included into RA group, tails were included into GA group. Thus, these patients were divided into RA group (n=17) and GA group (n=17) by a simple random sampling method, tossing a coin. The end point of the study was planned for 2years. Anaesthesia Technique All patients received I.V. premedication with 0.05mg/kg midazolam and a 50mL normal saline solution in the preoperative care unit. After patients were taken to the operating room, baseline blood pressure and heart rate measurements were recorded. Patients were seated at the operation table, the skin surface of the back was cleaned and sterilized with chlorhexidine and spirit. A combined spinal epidural set (18G epidural and 27G intrathecal needles) was used, 3mL of 2% lidocaine was injected into the skin and the subcutaneous tissue. The loss-of-resistance to saline was used to find the epidural space at L 2-3 or L 3-4 vertebrae, and 15mg of 0.5% bupivacaine heavy was given to intrathecal space. An epidural catheter was inserted 5cm inside and fixed to the skin surface. Motor block was assessed according to the modified Bromage scale; 0, no motor block; 1, hip blocked; 2, hip and knee blocked; 3, hip, knee and ankle blocked. If an adequate level of sensation was achieved, the operation was begun; if not, conversion to GA was applied and the patient was excluded from the study. If there were any signs of regression of block, or if the patient felt pain, 5mL of 0.5% bupivacaine was administered to the epidural catheter. All drugs and doses administered during the operation were recorded. After the operation, patients were transferred to the postoperative care unit (PACU)

 One µg/kg fentanyl, 2mg/kg propofol, 1-2mg/kg of suxamethonium were used for induction of the GA. Oro-tracheal intubation was performed after adequate muscle relaxation was achieved. Anaesthesia administration was achieved with 60% oxygen, 2 l/min flow rate, 0.8% to 3% isoflurane. At the end of the operation, 1gr paracetamol were administered. If muscle relaxation was detected during the operation, pancuronium 0.1mg/kg I.V. were applied. The neuromuscular block with atropine (0.01mg/ kg) and neostigmine (0.02mg/kg) was reversed after the operation was terminated. The patients were extubated when adequate spontaneous ventilation was detected and then transferred to the PACU. Patients with a Modified Aldrete score of 9 were transferred to the in-patient clinic from the PACU. The length of stay in PACU was recorded.

 All patients were visited before the day of the surgery, informed about the study and we explained the Visual Analog Scale (VAS) score, where ‘0’ score corresponds to no pain, and ‘10’ to maximum or worst pain. The postoperative pain was assessed by using VAS. VAS scores were recorded at 1, 3, 6, 12 and 24 hours after surgery. In the first 24 hours, if the VAS score was more than 6 points, the patient was given suppository diclofenac and 1gr of iv paracetamol. When the pain persisted, tramadol was injected and the amount was recorded, those for regional anaesthesia were given intravenous bupivacaine 0.125mg. At 24 hours postoperatively, patient satisfaction was scored from 1 to 5 (1-very bad, 2-bad, 3-moderate, 4-good, 5-very good).

**SURGERY**

For patients with/without preoperative stenting, a 9.5 French (Fr) semi-rigid URS was performed for optical dilatation and to visualize the entire ureter. Then, a guidewire was inserted into ureter and 11/13Fr ureteral access sheath was placed in all cases. The intrarenal collecting system was visualized with 7.5/8.5Fr flexible ureteroscope (Flex X2, Storz, Tuttlinger, Germany), and holmium laser with a 272µm fibre was used for laser lithotripsy. Nitinol baskets were used at the end of the lithotripsy to remove fragments from the collecting system, at surgeon’s discretion. Ureteral double J stent was inserted to every patient and removed 2 weeks after the operation. Demographic data of patients and stone characteristics, operation time, fluoroscopy time, length of hospital stay, and stone-free rates (SFR) were recorded. Perioperative number of hypotension, hypertension, tachycardia and bradycardia were recorded. Anaesthesia-related side-effects in patients (nausea, vomiting, pruritus and respiratory depression) were noted. On first postoperative day, kidney-ureter-bladder (KUB) radiography was obtained to evaluate the localization of double j stent and residual stones. SFR was re-evaluated with non-contrast computed tomography (NCCT) after the first postoperative month. Success was considered as residues of <2mm or absence of any stone fragments. Moreover, the parameters affecting the comfort of the surgeon such as ergonomics, comfort of being sure about the safety of the patient, difficulty of laser focusing during surgery were assessed by the surgeon, scoring between 1 (very poor) and 10 (very good). The end point of this study was the effect of two anaesthesia regimens on the comfort of the surgeon, and the comparability of feasibility and safety against perioperative complications.

**STATISTICAL ANALYSIS**

All data was collected by the investigator and filled in a pro forma. All data were handled in confidence and analysed with Statistical Package for Social Sciences (SPSS) version 20 for Windows. Tables and figures were used to present the result, and expressed as median (inter-quartile range), proportion (number of patients), and mean ± standard deviation. Chi square test was used for test of significance between non-parametric variables such as pre-existing pathologies and adverse effect incidences, and student t test for parametric data. When the variables are skewed and/or the number of cases is small the non-parametric Chy-square test was used. A p value < 0.05 was considered significant.

**RESULTS**

A total of 34 patients were included in the study (17 in GA group and 17 RA group), no difference was detected between the two groups. In terms of age, sex, ASA score, stone size, location and operation side as listed in Table I

The mean operation time for GA group was longer but was not statistically significant (320.5±65.4, 302.5±6.72, p= 0.834) GA and CSE groups respectively. The fluoroscopy time was 246.3±70.4 (min) in GA group and 254.7±7.8 (min), p=0.77, there was no statistical difference. The mean duration of hospital stay was similar between the two groups p=0.01. At one-month postoperative visit, stone clearance was noted 15 of 17 in GA group and 13 0f 17 in CSE group. Intraoperative monitoring of vital signs revealed 3 patients in CSE group experienced bradycardia, and this was statistically significant (p=0.002), 1 had hypotension also significant (p=0.001). Two patients in CSE group had mucosal tear (p=0.006), but no complications were observed in the GA group. Table II

Post operative VAS scores for GA group were in 1hr (2.4±0.294,2.1±0.183,p=0.475), 3hr(2.1±0.183, 2.2±0.223,p= 0.852), 6hrs (2.2±0.246,2.1±0.215, p=0.309), 12hrs(1.0±0.293, 1.4±0.283, p=0.212), 24hrs(1.4±0.224, 1.5±0.211, p=0.218) GA and CSE Respectively.

Three patients in the GA group required postoperative analgesia, 2 was given tramadol and 1 NSAIDS (diclofenac) this was not significant, tramadol p=0.059 and NSAIDS p=0.012. During postoperative follow- -up, nausea and vomiting was not observed in any group. No itching or respiratory depression was observed in any patient. Patient satisfaction assessed 24hrs postoperatively, revealed similar results in both groups. Postoperative surgeon comfort assessed showed statistically significant results favouring the GA group (p=0.001).

Table 1 - Comparison of preoperative patient’s demographic data.

 **GA SAB P-value**

**Parameter n(17) n(17)**

Gender (M/F) 15/2 12/5

Age (years) 42.3±6.7 42.2±6.5 0.998

ASA 1.5±0.5 1.4±0.5 0.789

Stone size (mm) 18.8±5.0 16.7±2.0 0.097

**Stone location**

Renal pelvis 12 (63%) 7 (37%)

Multiple 3 (16%) 5 (26%)

Lower pole 1 (5%) 5 (26%)

Middle 1 (5%)

Operation side (R/L) 9/7 11/6 0.783

*Mean, SD-Standard deviation, %-Percentage, Chy-square, ASA-American Society of Anaesthesiology,R/L Right/Left.*

**Table 2 - Comparison of perioperative parameters and outcomes**

 **GROUPS**

**PARAMETER ( n)17 n(17) P-value**

OPERATION TIME (min) 320.5±65.4 302.5±6.72 0.834

FLUOROSCOPY (min) 246.3±70.4 254.7±57.9 0.770

HOSPITAL STAY (hrs) 64.4±10.0 64.2±10.1 0.01

**PERIOPERATIVE OUTCOMES**

Tachycardia 0 0

Bradycardia 0 3(15.8%) 0.002\*

Hypertension 0 0

Hypotension 0 1(5.3%) 0.001\*

**PERIOPERATIVE COMPLICATIONS**

Haemorrhage 0 0

Mucosal tear 0 2 (10.5%) 0.006\*

Perforation 0 0

Stone free status 15 (78.9%) 13 (68%)

***Statistically significant<0.05, Median, Standard deviation, %-Percentage***

**Table 3 - Comparison of postoperative parameters and outcomes.**

 **GROUP**

 **GA CSE P-VALUE**

Tramadol requirement first 24 hours 2 (10.5%) 1 (5.9%) 0.059

NSAID requirement first 24 hours 1(5.9%) 1(5.9%) 0.012

Nausea-vomiting first 24 hours 0 0

 Itching first 24 hours 0 0

 Respiratory depression first 24 hours 0 0

Patient satisfaction after 24 hours\* 4.5±0.51 4.4±0.6 2 0.343

Surgeon comfort\* 7.8±10.5 5.1±0.80 0.001\*

POST OPERATIVE VAS

 1hr 2.4±0.294 2.1±0.183 0.475

 3hrs 2.1±0.183 2.2±0.223 0.852

 6hrs 2.2±0.246 2.1±0.215 0.309

 12hrs 1.0±0.293 1.4±0.283 0.212

 24hrs 1.4±0.224 1.5±0.211 0.218

***Statistically significant<0.05, Mean, Standard deviation, %-Percentage, VAS –visual analog scale***

DISCUSSION

General anaesthesia and combined spinal epidural are safe methods of anaesthesia for F-URS but general anaesthesia showed increased significance in surgeon satisfaction. Traditionally F-URS procedures are performed under GA8,9 the reason is unclear, but may be due to the fact that patient under CSE is thought to have larger tidal volume resulting in greater diaphragm and renal movement, thus causing inability to reach stones, which is not well tolerated by surgeons during stone fragmentation.10

Both GA and CSE have their advantages and disadvantages, in terms of surgeon’s comfort, surgery success, patient comfort and complication rates. GA has the advantage of the anaesthetics being in control of the patients breathing and tidal volume, but patients with CSE, have less anaesthesia cost, no airway manipulation and its complications, fewer drugs usage, reduced risk of thromboembolic events, shorter operative time and less post operative pain.11

Some studies13,14 report lower VAS for post operative pain in percutaneous nephrolithotomy (PCNL) procedures with spinal and epidural anaesthesia compared to GA, but in F-URS pain assessed at different times post operatively was not significantly different in both groups.15 This similar to the results in the study and may be attributed to the minimally invasive nature of the F-URS procedure; which is associated with no post operative pain.

 F-URS aims at complete stone clearance, managing nephrolithiasis with minimal morbidity, by using minimally invasive treatment. In the index study complete stone clearance was achieved in 78.9% for GA group and 68% in CSE, higher in the GA but not statistically significant (0.342). This similar to Zeng et al. (12) performed f-URS in a total of 65 patients under GA (n=34) and RA (n=31). Similar to our results, their stone clearance rates were 70.6% in GA and 67.7% in RA group, not significantly different, also Sahan et al (15) with complete stone clearance achieved in 77% of patients in GA group and 86.7% of patients in RA group. No significant difference was detected among groups in terms of stone clearance (p=0.215).

The complications noted in this study was seen more in the CSE group, this may be attributed to the inadequate stabilization of respiratory muscle by CSE, and thereby causing difficulty of laser focusing during stone fragmentation due to increased mobility of the kidney during surgery. But drug requirement was required in the GA group compared to the CSE group, although not statistically significant.

Mucosal tear was noticed in 2 patients in the CSE group (10.5%, p= 0.006), incidence of bradycardia and hypotension was higher in the CSE group. This is similar to Sahan et al10 but for hypotension which was not noticed. In contrast to Zeng et al12 their was no significance between the two groups, in terms of operative complications, mucosal injury. They also found bradycardia but was not statistically significant.

 Patient satisfaction was similar in both groups which is similar to Sahan et al. this in contrast to karacarla et al15, that found an increase in patient satisfaction in the CSE group.

Inasmuch as GA and CSE have their draw backs, most of the disadvantages of CSE can be eliminated by the use GA for F-URS, which can positively affect parameters such as ergonomics and laser focusing, thus improving the comfort of the surgeon. In the index it was noticed that the surgeons where more satisfied with the GA compared to CSE (p=0.001). This similar to the study by Sahan et al,10 which was the only study assessing surgeon satisfaction in F-URS. Another important point is the fact that the results obtained with CSE were not worse than that for the GA group. The overall success rate of anaesthesia was 100%, with nobody in the CSE needing conversion to GA. Owing to the fact that F-URS procedures are safe with very low morbidity rate, we will advise that under similar clinical and economic conditions F-URS can be performed under CSE in any patient if general health status allows.

The index study was the first to asses, anaesthesia type in f-URS cases in terms of success, complications and surgeon comfort in our environment. However, it has some limitations. Small sample size , most of the included studies where from china therefore limits the generalization of the study. The study would have been better generalised if it was a multicenter study.

**Conclusion**

In conclusion although our observation on this small number of patients need be verified, with more case, we were able to deduce a decreased surgeon comfort in the CSE group with associated mucosal tear and bradycardia.

**List of Abbreviation**

GA-General Anaesthesia

CSE-Combined Spinal Epidural Anaesthesia

F-URS-Flexible Ureterorenoscopy

ASA-American Society of Anaesthesiologists

SFR-Stone-Free Rates

KUB-Kidney-Ureter-Bladder

NCCT-Non-Contrast Computed Tomography

NSAIDS-Non-Steriodal Anti-Inflammatory Drugs

PCNL-PerCutaneous NephroLithotomy

**Statement of ethical approval**

Ethical approval was sought and obtained from hospital ethical committee

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