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Feasibility and Safety of Outpatient Lumbar Microscopic Discectomy in a Developing Country

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Study Design: Prospective study.

Purpose: To verify the feasibility and safety of outpatient microscopic lumbar discectomy (MLD) in a developing country.

Overview of Literature: Outpatient MLD is advantageous in terms of cost effectiveness and avoidance of nosocomial infections. Safety of outpatient MLD has been well established in the developed nations of North America and Europe. There is no published study of outpatient MLD from the rest of the world, especially in developing countries.

Methods: Fifty-eight consecutive patients undergoing outpatient MLD with a median follow-up time of 12 months (range, 6–21 months) were included in this study. Simultaneous patient counseling was done by a surgical and anesthetic team preoperatively and pre-discharge. We collected and analyzed data pertaining to the demography, socioeconomic status, perioperative parameters, complications, and outcome assessment scores of the patients.

Results: The average patient age was 37.8±9.6 years (39 males, 19 females). Unilateral discectomy was performed in 55 patients, and bilateral discectomy in three. The majority (80.3%) of the patients were classified to lower middle (III) or upper lower (IV) class on the Modified Kuppuswamy Scale. The average operative time was 41.0±8.4 minutes with an average blood loss of 42.6±14.9 mL. The average postoperative stay was 5.5±0.7 hours and the successful discharge rate was 100%. Complications noted were postoperative nausea (n=8), urinary retention (n=2), meralgia paresthetica (n=3), delayed wound healing (n=2), and recurrence (n=1). The successful outcome rates were Visual Analog Scale (VAS) score leg pain, 93.1%; VAS score back pain, 89.6%; Oswestry Disability Index score, 91.3%; return to activities of daily living, 94.8%; return to work, 79.3%; patient satisfaction rate, 82.7%; and overall success rate, 88.4%.

Conclusions: Outpatient MLD can be safely performed with success, even in the setting of a developing country, if the prerequisites of appropriate patient selection, arduous adherence to outpatient surgery protocol, competent surgical/anesthetic team, and infrastructure needed for conduction of microsurgery are met.

Keywords: Discectomy; Minimally invasive surgical procedures; Ambulatory surgical procedures; Developing countries

Introduction

Lumbar discectomy is one of the most common surgeries performed for indicated cases of sciatica secondary to intervertebral disc herniation (IDH). At the time of this writing, microscopic lumbar discectomy (MLD) is still considered the 'gold standard' technique. Traditionally, patients are admitted after MLD, but there has been a steady decline in the duration of hospitalization. Currently, at most centers, 1 to 3 days is the usual postopera-

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tive stay. With advancement in minimally invasive surgical techniques, improvement in anesthetic medications, and better understanding of the disease, safe conduction of MLD on an outpatient basis has been well established in Western countries over the last 2 decades [1-22]. The first outpatient microdiscectomy was performed by Zahrawi [17] in 1985. Outpatient microdiscectomy has been shown to have no significant differences in outcomes compared to lumbar microdiscectomy performed in inpatients, but tends to have fewer short-term complications [6] and better cost effectiveness [2,13,14,16,19,22]. So far, all published studies of outpatient MLD have been conducted in developed nations in North America [6-8,10-17,19,20,22] and in Europe [2-5,9,18,21]. Unfortunately, there is a dearth of published studies of outpatient MLD from the rest of the world. In particular, developing countries like India have unique challenges in terms of a diverse healthcare delivery system, lower health awareness among its population at large, and poorer socioeconomic scenario. Thus, it is imperative to determine if outpatient MLD is feasible in the setting of a developing country where reduction of treatment costs is a priority. The purpose of this study was to determine the feasibility and safety of outpatient MLD in India.

Materials and Methods

1. Patients

This prospective study was approved by the ethical committee of Apollo Hospitals (IRB approval no., AHB/CR/96/26-07-2016). We studied patients who had an outpatient MLD by a single surgeon from July 2016 to November 2017. All patients were between 18 and 55 years old and presented to our department with single level IDH, with complaints of severe persistent pain with or without neurological deficit not responding to conservative management for at least 6 weeks, or IDH with progressive paresis or cauda equina syndrome. It was mandatory to have magnetic resonance imaging findings of disk herniation, compressing the nerve root either unilaterally or bilaterally and correlating with clinical symptoms and signs. The subjects should not have any major comorbidities (American Society of Anesthesiologists [ASA] grades 1 and 2), should be psychologically and mentally stable, with a body mass index <35 kg/m^2, and availability of a responsible caretaker. Patients with multilevel disk and those with failed back syndrome with segmental instability were excluded from the study. The patients were briefed preoperatively about the merits and demerits of the procedure and informed consent was obtained from those willing to participate in our study. The surgical and anesthetic team provided detailed counseling preoperatively and also informed patients of the possibility of hospitalization in the case of adverse events.

2. Surgical technique

The patients were given general endotracheal anesthesia, prone-positioned, surgical level marked with image intensifier, and infiltrated with 2% lignocaine and adrenaline (dilution, 1:2,00,000). Using a 2-cm midline skin incision, unilateral paraspinal muscles were dissected to expose the interlaminar window, and a McCulloch retractor with blade and hook was placed. Then, under microscopic visualization, partial flavectomy was done, and the extruded or sequestrated portion of the disk was removed from the axilla or shoulder of the root depending upon its location, followed by a thorough forceful wash to ascertain the removal of all loose disk fragments. Adequate epidural hemostasis was ensured before closure and the wound was infiltrated with bupivacaine.

Postoperatively, the patients were monitored in recovery and usually mobilized with a lumbar corset once fully awake, and with tolerable pain. The patients were then discharged directly from the recovery unit after they had voided urine, were fully awake and hemodynamically stable, had limb motor power and sensation similar to preoperative status, acceptable pain scores, and were able to mobilize safely. A score greater than 9 on the modified Post-Anesthetic Discharge Scoring System scale was also used as a discharge criterion [23]. The patients were seen by the surgical team and cleared by the anesthetic team prior to discharge to ensure complete adherence to the discharge protocol. The patients were informed about complications or adverse events to watch for, along with written instructions and a contact number for a team member in case they required follow-up. The outstation patients were advised to stay overnight in a nearby hotel. One of the residents called the patients to determine wellness on the night of the surgery and ensuing morning. The patients were asked to inspect the dressing on the second postoperative day and to return for suture removal on the 12th day (in our hospital for local patients and at a nearby hospital for outstation patients) and were followed-up at the outpatient department at 1-, 2-, and 6-month intervals. The patients were instructed to avoid prolonged sitting, jerky road travel, forward bending, and lifting weights for at least 3 weeks. After the 3 weeks, they were allowed to resume their jobs with modification for a month if their jobs required heavy manual labor. The parameters documented prospectively during the study were age and sex distribution, level involved, side of involvement (unilateral/bilateral), neurological status, socioeconomic status (Modified Kuppuswamy Scale) [24], ASA grade, operative time, intraoperative blood loss, duration of hospital stay, complications, successful discharge rate, VAS score for leg pain and back pain, Oswestry Disability Index (ODI) score, return to activities of daily living (ADL), return to work, patient satisfaction rate, and overall success rate. A *p*-value (significance) of <0.05 was deemed statistically significant. Mean, standard deviation, standard error, and 95% confidence intervals were calculated. Analysis of variance (ANOVA) and Kruskal-Wallis test were used to test independent quantitative variables that were normally or not normally distributed having multiple grouping variables, respectively.

Results

The mean age of the patients was 37.8±9.6 years (range, 18–55 years). Among all of the patients (n=58), 39 (67.2%) were males and 19 (32.8%) were females (Table 1). The majority (80.3%) of the patients belonged to the lower middle (III) class or upper lower (IV) class as graded by the Modified Kuppuswamy Scale [24]. Forty-two patients were ASA grade I and 16 patients were ASA grade II. The most commonly involved vertebral segment was the L5–S1 level (51.7%) followed by the L4–L5 level (44.8%). The side of involvement was predominantly unilateral in 55 patients (94.8%). Bilateral MLD was performed in three cases. Twenty-one patients had a neurological deficit, with seven having IDH at the L4–L5 level and 14 patients at L5–S1 level. Three of the cases were recurrent disk surgeries with clinical findings correlating with IDH which required a redo discectomy. The mean operative time was 41.0±8.4 minutes. Most patients had a 40–50-minute surgery duration (23 patients, 39.7%) followed by 21 patients (36.1%) who had a 30–40-minute surgery duration and five patients (8.6%) who had a 20–30-minute surgery duration. Only nine patients (15.52%) had an operative time of more than 50 minutes. The average blood loss among all patients was 42.6±14.9 mL. The average time duration of the postoperative hospital stay was 5.5±0.7-hour stay (the time from arrival of the patient to the recovery room till discharge). Most patients (n=27, 46.6%) stayed between 5 and 6 hours in the hospital after the procedure. The hospital stay was 6–7 hours for 17 patients (29.3%), 4–5 hours for 10 patients (17.2%), and the least number of patients (n=4, 6.9%) stayed for 7–8 hours. The successful same-day discharge rate of our study was 100%.

Table 1. Demography of patients (N=58)

Characteristic	Value
Age (yr)	37.79±9.55 (range, 18–55)
Sex (male:female)	39:19
Socio-economic status (Modified Kuppuswamy Scale)	
Upper middle (II)	12 (20.68)
Lower middle (III)	28 (48.27)
Upper lower (IV)	21 (36.2)
American Society of Anesthesiologists grade	
Grade I	42 (72.41)
Grade II	16 (27.58)
Level involved	
L5–S1	30 (51.72)
L4–5	26 (44.82)
L3–4	2 (3.44)
Side of surgery	
Unilateral	55 (94.82)
Bilateral	3 (5.17)
Neurological deficit	
Total	21 (34.42)
L4–L5	7 (33.33)
L5–S1	14 (66.66)
Mean operative time (min)	40.96±8.4
Average blood loss (mL)	42.58±14.93
Average hospital stay duration (hr)	5.48±0.74
Complications	
Postoperative nausea and vomiting	8
Postoperative urinary retention	2
Delayed wound healing	2
Meralgia paresthetica	3

Values are presented as mean±standard deviation, number, or number (%).

Eight patients (13.7%) experienced postoperative nausea and vomiting (PONV), which settled after treatment with antiemetic medications. Two patients with postoperative urinary retention (POUR) were discharged with an indwelling catheter and were reviewed on the ensuing morning for catheter removal. In the subsequent follow-up, there were two cases of delayed wound healing, which appeared to be due to wound stretching, but there was no pus discharge on exsanguination. Both patients' wounds healed with regular dressings and 5 days of oral antibiotics. Three cases of meralgia paresthetica were noted and were resolved with time. The median follow-up time was 12 months (range, 6–21 months). None of the cases had deep infections, spondylodiscitis, or postoperative neurological deterioration. One patient had a recurrent disc on the same side after 8 months of index surgery; this was relieved with redo outpatient MLD. None of the patients in this series needed hospitalization after discharge until the final follow-up.

The mean VAS scores for leg pain were 7.4±0.9 preoperatively and 3.7±1.1 postoperatively, and 3.2±0.9 and 2.4±0.9 at the 1- and 6-month follow-ups, respectively. The leg pain VAS scores were significantly different between the pre- and the three postoperative follow-up time points (ANOVA, $p<0.001$). To evaluate the successful relief rate of VAS score for leg pain, the patients were grouped into success (scores, 0–4) or failure (scores, 5–10) at the end of the 6-month follow-up [12]. At the 6-month follow-up, the successful relief rate of the VAS score for leg pain was 93.1% (success, n=54; failure, n=4).

The mean VAS score for back pain was 5.3±1.7 preoperatively followed by 4.0±1.1 in the postoperative period, and 3.32±0.9 and 2.77±0.8 at the 1- and 6-month follow-ups, respectively. The back pain VAS scores were significantly different between the pre- and three postoperative follow-ups ($p<0.001$). The patients were grouped into success (scores, 0–4) or failure (scores, 5–10) at the end of the 6-month follow-up. The successful relief rate of the back pain VAS score was 89.6% (success, n=52; failure, n=6).

The mean ODI score was 52.8±13.1 preoperatively followed by 26.5±4.2 in the postoperative period, and 17.9±4.2 and 11.4±3.9 at the 1- and 6-month follow-ups, respectively. The differences in the ODI scores were statistically significant between the pre- and three postoperative follow-ups ($p<0.001$). ODI scores below 40% were graded as good outcomes (success), whereas higher scores were considered partial or total failures [12]. While 54 patients had an ODI score below 40% (success), five patients had higher scores (failure). The outcome rate for the ODI score was 91.3%.

The ability to perform normal ADL was graded on a four-part scale [12], in which a grade of 1 was considered 'excellent' (no limitations); 2 was considered 'good' (one or more minor limitations but most ADLs can be accomplished); 3 was considered 'fair' (one or more limitations that interfere seriously with ADL); and 4 was considered 'incapacitated' (unable to perform ADL at all). While grades 1 and 2 were rated as success, grades 3 and 4 were rated as failure. The rate of successful return to ADL was 94.8% (success, n=55; failure, n=3). Return to work was graded similar to return to ADL. We found that 46 patients were either graded 1 or 2 (success) and 12 patients were graded either 3 or 4 (failure) in our study. The successful rate of return to work was 79.3%.

A four-part scale was used to ascertain a patient's satisfaction with the results of surgery [12], with grades as follows: (1) very satisfied; (2) satisfied but with minor reservations; (3) partly satisfied but with major reservations; and (4) not satisfied at all. Grades 1 and 2 were rated as success, Grades 3 and 4 were rated as failure. In our study, at the 6-month follow-up, 48 patients were either graded 1 or 2 (success) and 10 patients were graded either 3 or 4 (failure). The patient satisfaction rate was 82.7%.

According to Mac Nab's criteria for outcome assessment, in our study, 26 patients had an excellent outcome, 24 had a good outcome, five had a fair outcome, and three had a poor outcome. We used the parameters used by Asch et al. [12], one of the most cited publications in current available literature, for evaluating the success rate of outpatient MLD. The overall success rate of the study was determined by calculating the average of various parameters such as the successful relief rate of the VAS score for back pain and VAS score for leg pain, the outcome rate of ODI score, the patient satisfaction rate, the rate of successful return to ADL, and the successful rate of return to work [12]. The overall success rate of our study was 88.4% (Table 2).

Discussion

The standard postoperative hospital stay protocol following MLD has undergone progressive reduction; so much so, that some are even performed on an outpatient basis, although the majority of them are still being done on in-

Table 2. Outcome scores

Outcome parameters	Preoperative	1st FU	2nd FU	Final FU	Success rate (%)
VAS leg pain	7.4±0.86	3.7±1.07	3.2±0.9	2.4±0.9	93.1
VAS back pain	5.34±1.66	3.96±1.07	3.32±0.9	2.77±0.8	89.6
Outcome rate for ODI score	52.75±13.07	26.47±4.2	17.92±4.16	11.39±3.9	91.3
Return to ADL	-	-	-	-	94.8
Return to work	-	-	-	-	79.3
Patient satisfaction	-	-	-	-	82.7
Overall success rate	-	-	-	-	88.4

Values are presented as mean±standard deviation.
FU, follow-up; VAS, Visual Analog Scale; ODI, Oswestry Disability Index; ADL, activity of daily living.

patient basis. So far, published studies on outpatient MLD have been conducted only in developed nations (Table 3) [2-21], and there are no studies from a developing country which can verify the feasibility and safety of outpatient MLD. The current study was performed a tier-3 city in India, which is ideal to determine if this procedure of outpatient microdiscectomy is feasible in developing countries. Outpatient surgeries allow for optimal utilization of healthcare infrastructure and can reduce the waiting period of operations in heavily burdened inpatient units. This aspect can be useful to compensate for population healthcare-facility mismatch, which is widely prevalent in developing countries. The cost reduction advantage of outpatient vis-a-vis inpatient microscopic discectomy is self-evident and has been shown in previous studies [13,14,16,19,22]. This cost reduction is even more important for economically poor societies, which are large populations in developing countries. The majority (80.3%) of the patients in our study belonged to the lower middle (III) class or upper lower (IV) class as graded by the Kuppuswamy Scale to quantify the socioeconomic status of patients [24], a metric which has not been analyzed in previous studies. The primary reason for starting an outpatient MLD service in our clinic was to benefit patients who require MLD but suffer financial difficulties. In our clinic, the cost of inpatient MLD including 1–2-day hospitalization costs approximately $1500, compared to only $1000 for outpatient MLD. To our surprise, all eligible patients agreed to the outpatient microdiscectomy procedure over the inpatient procedure, after counseling, despite a lack of awareness among them as no other medical centers in our region are offering outpatient MLD. We believe that cost reduction was one of the most crucial deciding factors for these patients. Bekelis et al. [22] demonstrated that a higher income is associated with decreased acceptance of outpatient procedures. The cost advantage of day-care surgery might be of less value to patients with health insurance. However, in developing countries like India, the number of people with adequate healthcare is limited. According to the National Heath Profile database, only 27% of Indians have health insurance, leaving 1 billion of India's 1.35 billion population with no coverage for health expenses and having to bear out-of-pocket expenditures. In such circumstances, day-care MLD can provide some economical relief to a large fraction of the population needing such a service. Hospitals in developing countries are diverse in infrastructure, ranging widely from small, less-equipped hospitals to large, well-equipped hospitals that are comparable to centers in developed countries. Day-care MLD would be limited to centers with adequate surgical and anesthetic facilities equipped for microsurgical spine surgery.

The distance from hospital has been considered in many studies as a parameter to be accounted for eligibility for outpatient MLD [2,11,13,21]; however, we think that by offering an option for patients to stay overnight in a nearby hotel makes the distance inconsequential. There was a tendency for elderly patients to avoid outpatient MLD in earlier studies, but Best and Sasso [8,10] reported that outpatient MLD can be safely conducted in both very young/adolescent patients [8] and very old (>65 years) patients [10]. However, our study was a pilot study in the setting of a developing country; thus, we only included patients between 18–55 years. Some studies have stated that previous lumbar surgery, multilevel lesions, or a need to do bilateral MLD is a contraindication for outpatient MLD [2,3,5]. However, many authors have safely conducted this procedure in these previously excluded cases

[7,11,13,15,16,19]. In our study, there were three cases of redo discectomies and three needing bilateral discectomies; however, we restricted ourselves only to single level cases.

Throughout the current study, we ventured upon various issues impacting the dynamics of outpatient MLD, but the principal focus was on the success, safety, and feasibility of the procedure. The success of any outpatient surgery depends on the ability to successfully discharge patients with minimal complications. An exhaustive literature review was performed prior to the inception of this study to determine possible causes of discharge failure (Table 3), and we found that patient anxiety [2,15], postoperative pain [3,5,7,9-11,14,19], PONV [3,7,10,11,13,15,17,18], POUR [3,7,10,11,13-15,17], and dural tear [3,7,9-11,13,18,19] were the commonly stated reasons for discharge failure (Table 3). Appropriate patient selection is the cornerstone of outpatient MLD, with proper indication and patient acceptability being the key factors. Structured patient education protocol implementation with concomitant counseling by a surgical and anesthetic team was useful in ensuring patient acceptance of discectomy as an outpatient procedure. Availability of a proper caregiver is necessary to provide the requisite postoperative support, although in developing countries joint families are still prevalent; therefore, this was almost never a concern in our study. An amalgamation of all these measures ensured that we did not encounter any case of postoperative anxiety, which was identified as an important reason for discharge failure. Minimizing intraoperative soft tissue dissection, adequate perioperative multimodal analgesia, and wound infiltration with bupivacaine before skin closure alleviated the issue of postoperative pain [3]. The incidence of PONV was 13.7% in our study, but none of these cases were severe enough to affect patient discharge. PONV can be avoided by employing several measures such as proper fluid management, adequate antiemetic prophylaxis, usage of anesthetic agents which have minimal emetogenic side effects, and by limiting the use of strong opioids for postoperative pain management [11]. Bednar [15] reported that urinary retention was the reason for 29% of the discharge failures in the primary cohort and 100% in the secondary cohort of their study. Our experience with two cases of POUR demonstrated that these cases could be managed even on an outpatient basis. No cases of dural tear were encountered during the study. Arduous adherence to protocols and good surgical technique ensured that there were no discharge failures.

Two cases of delayed wound healing and three cases of meralgia paresthetica were noted in our study, which were resolved during subsequent follow-ups. There was one case of recurrent disc herniation, which was relieved with redo outpatient MLD. Overall, our study had a low complication rate, which is consistent with previous studies [2-21]. Possible reasons for lower complication rates could be that our patients were younger with relatively fewer comorbidities, the shorter operative time, the early mobilization, which reduces the probability of DVT, prevention of invasive procedures like urinary catheterization, the decreased hospital stay, reducing the chance of nosocomial infections, and the tendency of the patients to recover faster at home due to a supportive social environment. A major concern in discectomy remains unrecognized intraoperative vascular injury (although rare) or postoperative hematoma, which can be catastrophic [4]. Careful monitoring is mandatory to avoid these complications and to recognize and intervene as soon as possible, if they do occur. The most common signs and symptoms of vascular injuries are hypotension, tachycardia, wide pulse pressure, trauma bleeding, and abdominal distention during or shortly after the operation [25]. Paying close attention to intraoperative hypotension or bleeding using Shevlin's test and abdominal auscultation before discharge are some of the few precautions to avert missing vascular injury [25]. Postoperative hematomas usually appear in 4–6 hours and their early recognition can avert/relieve neurological deterioration; thus, close observation for the same time period should be sufficient, which concurs with the length of postoperative stay in most studies, including ours.

While the success rate of outpatient MLD has varied extensively from 75% to as high as 95%, one of the most cited publications available in the literature by Asch et al. [12] reported that a 75%–80% success rate is more realistic than the 90% or more reported in other works. They observed that in a linear correlation analysis of data obtained in patients ranging from 25 to 56 years of age, for every additional year of age, the leg pain-related failure rate was estimated to increase by 6%. Therefore, the relatively young cohort in our study probably explains the higher success rate of the patients in our study.

There are a few limitations to our study which warrant discussion, such as the small sample size, the relatively short follow-up time, and the absence of a control group. However, the sample numbers are sufficient to establish

Table 3. Summary of published studies of outpatient microscopic discectomy [2-21]

Author	Study design	No. of patients	Age range	Hospital/ ASC	Country	Successful discharges (%)	Reason for discharge failure
Debono et al. [2] (2017)	Retrospective	201	23–77	ASC	France	200/201 (99.99)	Anxiety attack (1)
Ahuja and Sharma [3] (2017)	Retrospective	95	20–79	Hospital	UK	85/95 (89.47)	Intraoperative: dural tear (2), transient heart block (1); postoperative: severe back/leg pain (3), prolonged anaesthetic recovery (1), PONV (1), PONV & urinary retention (1), partial foot drop (1)
Helseth et al. [4] (2015)	Prospective	1,073	16–86	ASC	Norway	1,072/1,073 (99.90)	Retroperitoneal hematoma (1)
Abou-Zeid et al. [5] (2014)	Prospective	50	21–73	Hospital	UK	36/50 (72)	Postoperative back pain (5), symptomatic hypotension (5), patient's choice (3), afternoon case (1)
Pugely et al. [6] (2013)	Prospective	1,652	-	Hospital	USA	NM	NM
Fallah et al. [7] (2010)	Retrospective	NS: 269; SS: 137	-	Hospital	Canada	SS: 129/137 (94.16); NS: 258/269 (95.91)	Dural tear (3), airway compromise (3), urinary retention (2), pain management (2), vomiting (2), hemibody numbness (1), patient's request (1), undocumented (5)
Best and Sasso [8] (2010)	Retrospective	31	14–19	Hospital	USA	19/19 (100.0)	-
Pedrosa et al. [9] (2010)	Retrospective	87	20–67	ASC	Portugal	84/87 (96.55)	Dural tear (1), pain (1), lack of accompanying person (1)
Best and Sasso [10] (2006)	Retrospective	1,377	14–92	Hospital	USA	1,353/1,377 (98.25)	Pain (12), urinary retention (8), cerebrospinal fluid leak (2), nausea/vomiting (1), sedation (1)
Shaikh et al. [11] (2003)	Retrospective	106	43 (mean)	Hospital	Canada	100/106 (94.33)	PONV (2), dural tear (2), postoperative urinary retention (1), pain (1)
Asch et al. [12] (2002)	Prospective	212	25–56	Hospital	USA	NM	NM
Singhal and Bernstein [13] (2002)	Prospective	122	23–74	Hospital	Canada	116/122 (95.08)	Dural tear (2), PONV (2), urinary retention (1), severe laryngospasm (1)
An et al. [14] (1999)	Prospective	61	20–59	Hospital	USA	57/61 (93.5)	Lack of patient carer (2), inability to void (1), inadequate pain control (1)
Bednar [15] (1999)	Prospective	130	26–63	Hospital	Canada	121/130 (93.07)	Anxiety (3), urinary retention (3), PONV (2), urinary retention & anxiety & PONV (1)
Wohns and Robinett [16] (1996)	Prospective	60	NM	ASC	USA	60/60 (100.0)	NA
Bookwalter et al. [19] (1994)	Prospective	74	19–64	Hospital	USA	68/74 (91.89)	Pain (3), dural tear (1), dizziness (1), vertigo (1)
Kelly et al. [18] (1994)	Prospective	100	20–65	Hospital	UK	93/100 (93.0)	PONV (2), lack of ambulance (2), dural tear (1), pregnant patient (1), intraoperative decision for 2 levels surgery (1)
Zahrawi [17] (1994)	Prospective	103	17–62	Hospital	USA	100/103 (97.08)	PONV/urinary retention (3)
Cares et al. [20] (1988)	Prospective	10	31–51	Hospital	USA	NM	NA
Griffith and Marks [21] (1987)	Prospective	14	-	Hospital	UK	NM	NA
Our study	Prospective	58	18–55	Hospital	India	58/58 (100.0)	NA

ASC, ambulatory spine center; PONV, postoperative nausea and vomiting; NM, not mentioned; NS, neuro-surgeon; SS, spine surgeon; NA, not applicable.

the feasibility and safety of MLD as an outpatient procedure. Also, a longer follow-up period is needed to assess the efficacy of the procedure. A comparative study conducted with inpatient, preferably randomized control study can better establish merits and demerits of either method.

This study was performed in an Indian, semi-urban area, and can aid in a better understanding of the merits and practical constraints of this procedure specifically to the Indian population. Although our outpatient MLD study was hospital-based, this sets a precedence for establishment of ambulatory spine centers in developing countries, which are already common in developed nations.

Conclusions

Outpatient MLD can be safely performed with success even in the setting of a developing country, provided that the surgical team is well experienced in microsurgical or minimally invasive techniques, patients are appropriately selected and adequately counseled, the anesthetic team is conversant with the nuances of anesthesia delivery in ambulatory surgery, and the operating infrastructure provides the needed support for microsurgery. Outpatient MLD should be offered as an option to patients needing discectomy surgeries to provide the benefit of fewer short-term complications and better cost effectiveness, which is a priority in developing countries where the socioeconomic conditions are less than ideal.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Author Contributions

Conception and design/supervision: Ashish Jaiswal; data acquisition/analysis: Satish Kumar; drafting: Shiva Reddy; and drafting/critical revision: Parineeta Jaiswal

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