AMBULATORY SURGERY

ISSN: 0966-6532

International Journal covering Surgery, Anaesthesiology, Nursing and Management Issues in Day Surgery

The Official Clinical Journal of the
INTERNATIONAL ASSOCIATION FOR AMBULATORY SURGERY

VOLUME 28.3 SEPTEMBER 2022

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Editorial

Mark Skues, Editor-in-Chief

After a heat fuelled summer in Europe and the United States that challenged the existing records, we return now to more balmy conditions as the year progresses. Similarly, after the excitement of convening at the last Congress in May, we return to more routine activities in this edition of the Journal.

Some rather sad news to begin with. I report the passing of Hanne Føns who sadly died in April of this year. Hanne was the Executive Lead for the IAAS for Denmark, as well as holding positions of Treasurer and President of the Danish Association of Day Surgery. Marie-Louise Ulsøe has put together a touching obituary for her that I include in this edition.

Thorner, Moss and Baker have submitted a study evaluating the use of supplemental oxygen to decrease the risk of post-operative nausea and vomiting. They administered 2L of oxygen via nasal cannulae in the post-operative care units for 15 minutes and then compared the rate of PONV with a non-oxygen control group. In patients with no history of PONV, only 8.9% experienced symptoms, compared with 22.8% who did. There was a much smaller none significant effect with those with an existing predisposition to nausea and vomiting (16.7% vs 19%).

An Indian study evaluated patient satisfaction after ambulatory arthroscopic anterior cruciate ligament reconstruction following up patients for 9 months after surgery. Perhaps predictably, they found the improvement of satisfaction with time after the operative procedure.

Secco and colleagues report on their experience with prostatic urethral lift under local anaesthesia. This is a technique for prostatic hyperplasia that the authors reported was straightforward and well tolerated by patients. Clinical outcomes for up to one year post-operatively confirmed clinical effectiveness.

Finally, Cirella et al provide a valuable review of the management of local anaesthetic systemic toxicity, and provide a useful checklist to follow in the event of occurrence. They also recommend the availability of 20% Intralipid emulsion for infusion in the event of such toxicity.

As we now move into something of a hiatus after the last international Congress, it's worth reflecting on the next IAAS event that will be held in Oslo in 2024. While it is some time away, rest assured that the same high quality of speakers and subjects will be presented at this future meeting.

Dr Mark Skues
Editor-in-Chief

Obituary – Hanne Føns

Marie-Louise Ulsøe

Hanne Føns passed away on the 28th April 2022 following a long illness. Hanne was Nursing Head of Unit, Department of Anesthesiology, Nordsjællands Hospital since 2013. She had a long history of working in the hospital and health care sectors.

She was elected to the board of the Danish Association of Day Surgery (DSDK) in 2008. She served as Treasurer between 2009 – 2016 and was President from 2016 – 2021.

Hanne was an extremely popular member of the IAAS serving on the General Assembly for 7 years and on the Executive Committee for 5 years. She worked purposefully to promote Ambulatory Surgery within Denmark and Internationally supporting our major projects with the European Union. She was a regular speaker at our International Congresses ensuring a nursing voice in the programme.

We will all miss Hanne as an inspirer, a good colleague, her good mood and lovely smile as well as her huge knowledge and experience in Ambulatory Surgery. Hanne leaves behind her husband, 3 children and 2 grandchildren. Honour be to Hanne`s memory.

Randomized Controlled Trial Evaluating the Use of Supplemental Oxygen Administered in the PACU to Decrease Postoperative Nausea and Vomiting

C Thorner, M Moss, R Baker

Abstract

Purpose: Postoperative nausea and vomiting (PONV) are common complications. The current study examines the effect of supplemental oxygen administered in the PACU on PONV, postoperative antiemetics, and length of stay.

Scope: This randomized controlled trial examined 169 adult patients undergoing outpatient surgery under general anesthesia.

Conclusions: Among patients with no history of PONV, those who received supplemental oxygen on arrival to the PACU had a lower incidence of PONV and antiemetic administration (8.9%) compared to patients who received standard care (22.8%), p=0.041. Administering oxygen in the PACU is a low-cost intervention to decrease the occurrence of PONV among low-risk patients.

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Introduction

Postoperative nausea and vomiting (PONV) are common complications for patients undergoing surgery with general anesthesia. It is estimated that approximately 25-30% of patients generally, and up to 79% of high-risk patients, experience PONV [1-7]. Patients who have one or more of the evidence-based predictors of postoperative nausea and vomiting are considered to be high risk of experiencing PONV. These evidence-based predictors include female sex, history of PONV or motion sickness, nonsmoking, and young age [8]. Postoperative nausea and vomiting can result in negative outcomes for the patient and the hospital. Preventing PONV can improve outcomes resulting improvements in patient satisfaction [3, 9], shorter lengths of stay in the post anesthesia care unit (PACU) [10, 11], decreases in unanticipated readmissions [12], and decreases in resource utilization and costs [10, 13].

Because of the multiple benefits of preventing PONV for the patient and hospital, it is critical that patients' PONV risk factors are assessed before surgery and used to guide PONV management during the surgical visit [8]. Anecdotally, nurses report that when they apply supplemental oxygen to patients in the PACU if they begin experiencing PONV, the nausea often is resolved and vomiting is prevented. A search of evidence to examine this anecdotal report found many studies that reported mixed results on the effect of intraoperative supplemental oxygen on occurrence of postoperative nausea and vomiting.

In a systematic review of ten randomized controlled trials comparing intraoperative 80% supplemental oxygen to 30-40% supplemental oxygen on the incidence of postoperative nausea and vomiting, Orthan-Sungar and colleagues [14] found that there was no significant difference in PONV related to the percent of supplemental oxygen. They concluded that the use of 80% supplemental oxygen is not an effective intervention to reduce risk of PONV. Several years later, Hovaguimian and colleagues [15] conducted a systematic review of 22 randomized controlled trials comparing high inspired oxygen fraction (FiO2) (80-100%) and normal FiO2 (30-40%). They reported a significant but weak effect of high FIO2 on nausea with a decrease from 24.8% of patients receiving normal FIO2 experiencing nausea to 19.5% of patients receiving high FIO2 experiencing nausea; risk ratio 0.79 (95% CI, 0.66-0.93). Finally, Fasquel and colleagues [16] conducted a systematic review of 23 studies comparing the use of high FIO2 to normal FIO2 among adult patients undergoing surgery with general anesthesia. They reported no significant decrease in PONV with intraoperative high FIO2.

In the time after these three reviews were conducted, there have been two studies published that have examined the impact of supplemental oxygen on incidence of PONV. Both of these studies examined only pediatric surgical patients. Izadi and colleagues [17] reported that pediatric patients undergoing tonsillectomy had significantly lower incidence of PONV in the first two hours surgery when high FIO2 was administered compared to normal FIO2. However, a study of pediatric patients undergoing strabismus surgery found no significant difference in PONV between patients who received high FIO2 compared to patients who received normal FIO2 [18].

The reviewed studies reported conflicting results on the impact of administering different rates of oxygen intraoperatively. Two systematic reviews found no impact of high FIO2 oxygen on incidence of PONV [14, 16] while the other systematic review found a significant decrease in risk of postoperative nausea among patients receiving high FIO2 [15]. Studies published since these reviews also found conflicting reports with one study finding a significant decrease in PONV when high FIO2 was administered [17] and one study reporting no significant difference in PONV [18]. Interestingly all these studies compared different rates of oxygen administered intraoperatively. To date, no studies have examined the impact of administering oxygen in the postoperative setting on PONV. And, no studies have compared the impact of postoperative oxygen administration and room air only with no oxygen administered on patient PONV.

The purpose of the study was to address these gaps in the literature and to determine if supplemental oxygen applied immediately upon arrival to PACU can significantly reduce occurrence of PONV in outpatient surgical patients receiving general anesthesia compared to not administering supplemental oxygen in the PACU. Specifically, the current study examines the impact of supplemental oxygen on occurrence of PONV in the PACU, antiemetic medication administration in the PACU, and length of stay in the PACU.

Methods

A block-randomized, non-blinded, controlled study was conducted in which patients were randomized either: (1) to receive 2L supplemental oxygen via nasal cannula administered on arrival to the PACU for 15 minutes and then weaned as tolerated by the patient, or (2) to receive standard care which involved remaining on room air and only receiving supplemental oxygen as needed to keep oxygen saturation levels greater than 92% or if patient began experiencing symptoms of PONV. Approval was obtained by the organization's Institutional Review Board (IRB) prior to beginning study procedures.

The study took place at a PACU with 19 postoperative recovery bays. The team members on this unit provide care for patients undergoing outpatient procedures including, cystoscopy, robotic procedures such as hernia repair and cholecystectomy, breast procedures including lumpectomy and mastectomy, orthopedic procedures such as laminectomy and anterior cervical discectomy and fusion, and gynecological surgeries including hysterectomy and dilation and curettage. There are approximately 30 surgeries performed in this setting each day, with approximately 15 surgeries being performed on an outpatient basis where the patient is discharged from the hospital following their recovery period.

Patients were eligible to participate in the study if they were 18 years old or older, were admitted for an outpatient surgical procedure performed under general anesthesia, had no underlying disease requiring oxygen, and were not administered an antiemetic agent or medication preoperatively, including application of a scopolamine patch. Preoperatively, a study team member met with potential participants, described the study, and answered any patient questions. If a patient was interested in participating in the study, informed consent was obtained.

Block randomization by PACU bay was used to assign patients to interventions. As patients come out of surgery, assignments to PACU bays were random. Approximately half of the PACU bays were designated "intervention" bays and signs were placed in these bays reminding the nurses that patients cared for in these bays were to receive 2L of oxygen via nasal cannula applied immediately upon arrival and for at least the first 15 minutes the patient was in the PACU. The other PACU bays were designated "control" bays and nurses in these bays followed standard practice that involved 2L of oxygen via nasal cannula only being applied if the patient's oxygen saturation fell below 92% or if the patient had complaints of nausea or vomited.

Every 1-2 weeks, manual chart reviews were performed on the charts of patients who signed the informed consent form. The study nurses confirmed that supplemental oxygen was administered for at least 15 minutes for patients in the intervention bays and documented whether oxygen was administered for patients in the control bays. From the chart review, the study nurses documented if the patient experienced PONV, if the patient received an antiemetic agent while in the PACU, and the patient's length of stay in the PACU. Finally, the study nurses obtained data on potentially confounding variables including type of surgery and if the patient had a history of PONV or motion sickness.

Results

A total of 248 patients were enrolled in the study. However, 42 patients who were scheduled for an outpatient surgical procedure were unexpectedly admitted to the hospital after surgery and therefore excluded from analysis. An additional 37 patients were removed from the analysis because they received an antiemetic agent or a scopolamine patch preoperatively. After these exclusions, 169 patients were included in the final analysis. Because of the random assignment to PACU bays and the multiple patients removed for exclusion criteria, the final number of patients in each group differed, with 69 patients in the intervention group receiving supplemental oxygen and 100 patients in the control group receiving standard care.

Just over half of the sample (55%) were female and 45% were male. Approximately 46% of procedures were laparoscopic or robotic. The most frequent surgeries included general surgical procedures (61.5%), gynecological procedures (16.6%), and urological procedures (9.5%). Most patients received intraoperative antiemetic agents with over 95% of patients receiving ondansetron 4mg. Only 3% of patients received no antiemetic agent intraoperatively. There was no significant difference in gender, whether the surgery was performed laparoscopically, the type of procedure, or type of antiemetic agent administered intraoperatively between the intervention and control groups.

After randomization, there was a significant difference between the two groups with a higher percent of patients in the intervention group having a previous history of PONV (34.8%) compared to the patients in the control group (21%), $p=0.046$. Because a history of PONV increases a patient's risk of subsequent PONV, this was a potential confounder and therefore, outcomes were analyzed separately for patients with a history of PONV and patients without a history of PONV. There were no other variables that significantly differed between the two groups (Table 1).

A Chi Square test was used to compare occurrence of PONV and occurrence of antiemetic agent administration in the PACU between patients in the two groups. A Mann-Whitney U test was used to compare length of stay in the PACU between the two groups. In all analyses, the level of significance was set at $\alpha=0.05$.

Among patients with no history of PONV, patients who received supplemental oxygen in the PACU experienced a significantly lower occurrence of PONV (8.9%) compared to patients who received standard care (22.8%), $p=0.041$. When examining patients with a history of PONV, there was no significant difference in occurrence of PONV between patients who received supplemental oxygen in the PACU (16.7%) and patients who received standard care (19%), $p=0.835$.

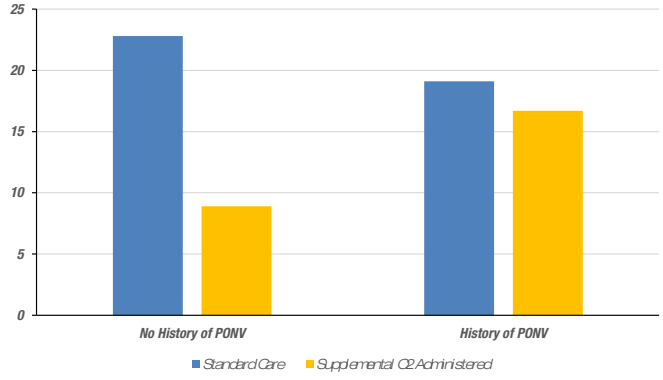
All patients who experienced PONV while in the PACU received an antiemetic agent. Therefore, the results when comparing antiemetic medication administration in the PACU between the groups were the same as the results when comparing PONV. Among patients with no history of PONV, a lower percentage of patients who received supplemental oxygen received an antiemetic agent in the PACU (8.9%) compared to patients who received standard care (22.8%), $p=0.041$. When examining patients with a history of PONV, there was no significant difference in occurrence of antiemetic medication administration in the PACU between patients who received supplemental oxygen (16.7%) and patients who received standard care (19%), $p=0.835$ (Figure 1).

When examining the length of stay in the PACU, no significant differences were found in either subgroup of patients. Among patients with no history of PONV, there was no significant difference in length of PACU stay between patients who received supplemental oxygen ($M=74.67$ min., $SD=28.14$) and patients who received standard care ($M=86.81$ min., $SD=48.34$), $p=0.348$. Similarly, among patients with a history of PONV, there was no significant difference in length of PACU stay between patients who received supplemental oxygen ($M=78.96$ min., $SD=22.40$) and patients who received standard care ($M=89.67$ min., $SD=51.65$), $p=0.891$.

Table 1 Sample Characteristics (n=169).

	Intervention Group (n=69)	Control Group (n=100)	*p*
Gender, n (%)			*p*=0.34
Female	28 (41%)	52 (52%)	
Male	41 (59%)	48 (48%)	
Laparoscopic/Robotic surgery, n (%)			*p*=0.23
Yes	28 (41%)	50 (50%)	
No	41 (59%)	50 (50%)	
Type of surgery, n (%)			*p*=0.40
General Surgery	43 (62.3%)	61 (61%)	
Gynecology	11 (15.9%)	17 (17%)	
Urology	8 (11.6%)	8 (8%)	
Ortho/Neuro	6 (8.7%)	8 (8%)	
Vascular	0 (0%)	3 (3%)	
Plastics	0 (0%)	3 (3%)	
Surgical Oncology	1 (1.4%)	0 (0%)	
Intraoperative antiemetic, n (%)			*p*=0.35
Zofran 4mg	64 (92.8%)	97 (97%)	
Decadron 4-10mg	61 (88.4%)	91 (91%)	
Pepcid 10-20mg	3 (4.3%)	4 (4%)	
Phenergan 6.25-12.5mg	1 (1.4%)	2 (2%)	
Benadryl 12.5mg	3 (4.3%)	0 (0%)	
Reglan 10mg	1 (1.4%)	1 (1%)	
None	3 (4.3%)	2 (2%)	
History of PONV, n (%)			*p*=0.046*
Yes	24 (34.8%)	21 (21%)	
No	45 (65.2%)	79 (79%)	

Figure 1 Percent of Patients who Experienced PONV and Received an Antiemetic in the PACU.



Discussion

Because of the multiple benefits of preventing PONV for the patient and hospital, it is critical that patients' PONV risk factors are assessed before surgery and used to guide PONV management [8]. Previous studies examining the use of intraoperative oxygen and its effects on PONV reported conflicting results. To date, this is the first study examining the administration of supplemental oxygen postoperatively to decrease the incidence of PONV and decrease the administration of antiemetic medication.

Limitations of this study include a relatively small sample size, especially considering the analyses were conducted on subgroups of the total sample. Future research should address the potential benefit of supplemental oxygen administered postoperatively in a larger group of patients. Additionally, the study was not blinded and patients who were aware they were not receiving the intervention may have been more sensitive to noticing postoperative nausea. Future research could compare supplemental oxygen provided postoperatively to patients who inhaled room air through a nasal cannula to decrease the potential for placebo effect.

In this study, there was no significant difference in incidence of PONV, antiemetic agent administration, or PACU length of stay among patients with a history of PONV. Patients with a previous history of PONV are at higher risk of subsequent episodes of PONV and may

benefit from more rigorous intervention. Since the current study found no benefit among the subgroup of patients with a history of PONV, additional research is needed regarding pharmacological and non-pharmacological interventions to decrease the incidence of PONV in these high-risk patients.

Interestingly, there was a significant decrease in incidence of PONV and administration of antiemetic medications in the PACU among patients with no history of PONV who received supplemental oxygen for the first 15 minutes in the PACU. This information can be useful when caring for patients in PACU who have no history of PONV or are experiencing their first surgery. Administration of 2L of oxygen via nasal cannulae in the PACU is a simple, non-pharmacological intervention that could reduce the incidence of PONV in this patient population.

Acknowledgements: The authors thank Becky Jones for her help with data collection, Kim Vossler for her help obtaining informed consent, and all the Bethesda North Hospital PACU staff nurses for their help with the study.

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Patient Satisfaction following Ambulatory Primary Arthroscopic Anterior Cruciate Ligament Reconstruction

MK Jain, SU Kamath, R Annappa, SL Krishnamurthy, J Austine, AV Guduru

Abstract

Aim: To compare the clinical outcome and patient related outcomes to assess patient satisfaction following ambulatory arthroscopic anterior cruciate ligament reconstruction.
Methods: Data collected preoperatively and postoperatively at intervals of 3, 6 and 9 months. Patients with meniscal repair, other ligament injury and articular cartilage injuries were excluded.
Results: Patient satisfaction increased with time. Statistically significant improvement in subjective scores of patient reported outcomes from preoperatively and at 3, 6 and 9 months post operatively.
Conclusion: Patients reported subjective scores found to be more helpful in determining patient satisfaction and final outcome.

Key words: Patient satisfaction, Functional outcome, Ambulatory surgery, Anterior cruciate ligament reconstruction.

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Introduction

Injury to the anterior cruciate ligament (ACL) is more common in young active adults especially those involved in sporting activities. It can also be isolated tear or associated with other injuries in the knee joint especially meniscal tears. Tears of the anterior cruciate ligament usually cause instability and can lead to problems in daily activities and also can lead to early onset arthritis (1).

Those who have sustained anterior cruciate ligament tear can have pain, swelling, feel of giving away and difficulties in walking on uneven surfaces, squatting and playing like before. The cause anterior cruciate ligament tears are usually twisting injury either due to sports or road traffic accidents or slip and fall.

Thorough clinical examination is required in diagnosing anterior cruciate ligament tear and also associated knee injuries. Magnetic resonance imaging is often required in confirmation of diagnosis and know other injuries. Various subjective scores are used to know the state of knee function.

In recent years arthroscopic anterior cruciate ligament reconstruction has been the choice of treatment by either using hamstring graft or patellar tendon bearing graft. This is to prevent knee joint from early arthritis and allow young adults to return to normal activities like before without much life style modification (1).

Among the many factors which can change the outcome of anterior cruciate ligament reconstruction are surgeon factors such as technical variation or graft used for surgery or patient factors like rehabilitation methods and life style changes.

Ambulatory arthroscopic ACL reconstruction has been a feasible and standard method in many centres across the world in the last 15 years.

Evaluation of a successful outcome after surgery was previously based on range of motion and absent preoperative symptoms. Recently, studies have come up which urge the importance of patient factors and their take on surgery, whether they are satisfied or not and if their expectations are met after surgery.

There are many subjective scorings available for determining functional outcome of anterior cruciate ligament reconstruction and also objective clinical tests. Patient reported outcomes (PRO) are there to assess knee function, quality of life, psychological factors, and return to sports. There are many subjective scores used to assess knee function but we have only limited data on which of these are actually helpful in deciding patient satisfaction (2). There are more than 50 unvalidated measures for anterior cruciate ligament injuries (3).

In our study we tried to know patient satisfaction following anterior cruciate ligament reconstruction using hamstring graft and how various patient reported outcomes are related to patient satisfaction.

We also tried to find out which among the various patient related outcomes actually determine patient satisfaction. We also compared patient related outcomes with clinical outcome criteria in determining patient satisfaction.

Materials and methods

This study is performed at Kasturba medical college and hospital Mangalore from 2019-2020 where 50 patients who had anterior cruciate ligament tear after being diagnosed clinically and by MRI scan were included in the study. This observational correlation study was done after getting informed consent from patient and clearance from hospital ethical committee.

A total of 40 males and 10 female patients were included in the study with mean age of 29.52 years. The inclusion criteria were age above 18 years, patients with complete ACL tear and with or without associated meniscal injury, those who Underwent ACL reconstruction using hamstring graft by single surgeon. Our exclusion criteria were patients who required meniscal repair, bilateral ACL tears, associated ligament injuries, Outerbridge grade III and grade IV chondral injury and previous knee surgeries

Pre-operative evaluation:

Detailed patient history was taken and clinical examination done for signs of ACL tear and questionnaires were given to fill the pre op subjective scores after MRI confirmation. Pre-operative subjective scoring was done using Lysholm score, IKDC score, KOOS score, SF-36, K-SES score (4).

After pre-operative evaluation all patients underwent Arthroscopic ACL reconstruction using hamstring graft and post operatively

standard ACL rehabilitation protocol was followed. At 3, 6, and 9 months post operatively clinical assessment was done by anterior drawer, Lachman, pivot shift and Mc Murray tests.

Patient reported outcomes were calculated using Lysholm score, IKDC score, KOOS score, SF-36, K-SES score. TAMPA scale of kinesophobia (5) was used to determine fear of reinjury in all the patients.

The primary outcome measure was to know patient satisfaction at 3, 6 and 9 months determined by asking the patient to rate it on a Likert scale from 1 to 10. Than all patients who rated their satisfaction below 5 were considered "dissatisfied" and 5-7 as "satisfied" and 8-10 as "mostly satisfied".

Data analysis was done using SPSS 17. Effect of all independent variables on satisfaction at 3 and 6 months were performed using Mann Whitney test and at 9 months using Kruskal Wallis H test. Comparisons among various satisfied groups were done using post hoc analysis. The significance level was set to be < 0.05.

Correlation among various independent variables was analysed using Pearson's co efficient. Relationship of dependent variable and best among patient reported outcomes was analysed using reverse regression analysis. Pre and post op statistical significance among subjective scores were analysed using ANOVA test. Objective clinical measures and their relationship with patient satisfaction at different follow up periods was determined using Fisher exact test.

Results

A total of 50 patients were taken up for study out of which 80% (n=40) were males and 20%

(n=10) were females. The mean age of all patients was 29.52 years. 42% were between the age group 21-30 yrs. and 28% between 31-40 yrs. 16% were 18-20 yrs. and 14% > 40 years. 57% (n=29) suffered injury to right side and rest on left side (n=21). Most of the ACL tears were due to participation in sporting activities. (n=23; 46%) and road traffic accidents (n=14; 28%). 11 patients sustained injury due to twisting injury to knee (22%) and 4 % (n=2) due to fall from height. Sports included mostly volleyball, football, cricket and basketball. One patient sustained injury while doing karate. Road traffic accidents were mostly due to skid and fall from bike .Among 10 females 70% sustained injury due to twisting injury due to slip and fall. 20% of them injured due to sports and 10% in road traffic accidents.

Patient satisfaction increased with time. At 3 months in our study we had only dissatisfied (38.7) and satisfied (61.3) patients but none were mostly or fully satisfied. Even at 6 months there were only dissatisfied (8.1%) and satisfied (91.9%) patients but none were fully satisfied. At 9 months about 69.3% of patients were fully satisfied in comparison to dissatisfied (6.1%) and satisfied (24.4%).

Assessing various patient reported outcomes with patient satisfaction (Table 1)

At 3 months only KOOS score (p=0.037) and K-SES score (p=0.015) were significantly correlating with patient satisfaction.

At 6 months Lysholm score (p=0.011) was significantly associated with patient satisfaction whereas IKDC and KOOS (p=0.004) and K-SES (0.005), SF-36 (0.007) TAMPA score (0.004) were highly significant in determining patient satisfaction.

At 9 months all the above mentioned scoring systems were highly significant in determining patient satisfaction as determined by Kruskal Wallis scale.

Table 1 Significant scores at various post-operative periods without regression analysis.

Time duration after surgery	Significant scores; p<0.005
3 months	KOOS, K-SES
6 months	Lysholm, IKDC, KOOS,
SF-36, K-SES, TAMPA	
9 months	Lysholm, IKDC, KOOS,
SF-36, K-SES, TAMPA	

We did post-hoc analysis after 9 months among all three satisfaction groups across various patient reported outcomes and observed that there was statistically significant difference of dissatisfied patients with those satisfied and mostly satisfied, with Lysholm, IKDC, KOOS, K-SES, SF-36, and TAMPA score. Among satisfied with mostly satisfied group at 9 months there was no significant difference with Lysholm, IKDC, KOOS score but noted significant difference with SF-36, K-SES, and TAMPA scale (p= 0.02,0.00,0.00 respectively) .

It was observed that all patient reported outcomes had positive correlation with each other as analysed by Pearson correlation scale.

Backward regression analysis at 3, 6 and 9 months (Table 2)

Table 2 Backward regression analysis of various patient reported outcomes.

Time duration after surgery	Significant scores; p<0.005
3 months	IKDC, KOOS
6 months	TAMPA
9 months	K-SES, SF-36, TAMPA

Among various patient reported outcomes showed at 3 months IKDC and KOOS (std. coefficient 0.625, 0.865) scores were highly reliable in determining patient satisfaction.

At 6 months it was TAMPA scale of kinesophobia with std. coefficient of 0.605 was highly significant in determining patient satisfaction.

At 9 months SF-36, K-SES, and TAMPA scale (0.295, 0.369, 0.346) were highly reliable scoring systems in determining patient satisfaction.

Analysis of clinical tests with patient satisfaction (Table 3)

Patients were clinically tested on their follow-up visits by doing Varus/valgus stress test, anterior drawer test, Lachman test, pivot shift test and mc. Murray test.

Anterior drawer test was positive in 12% of patients at 3 months and 10% at 6 months and again 12% at 9 months. Lachman test was positive in 22%, 20% and 22% at 3, 6 and 9 months respectively.

It was observed that at 3 months, six patients were having anterior drawer test positive (Grade-I) and eleven patients had Lachman test positive. (Grade-I). All were negative for Varus/valgus stress test and pivot shift test. Mc Murray test negative in all. It was found that anterior drawer test had significant effect on patient satisfaction (p=0.001).

At 6 months there was no significant effect of any of the clinical tests on patient satisfaction.

At 9 months pivot shift test had significant (p=0.028) effect on patient satisfaction.

Table 3 Analysis of clinical tests with patient satisfaction.

	Clinical tests	Fishers exact test p	
Time 3 months	Varus/valgus stress	.	
	Anterior drawer	**0.001**	Significant
	Lachman	0.055	
	Pivot shift	.	
	Mc Murray	.	
Time 6 months	Varus/valgus stress	.	
	Anterior drawer	0.482	
	Lachman	0.291	
	Pivot shift	0.763	
	Mc Murray	.	
Time 9 months	Varus/valgus stress	.	
	Anterior drawer	0.114	
	Lachman	0.854	
	Pivot shift	**0.028**	Significant
	Mc Murray	.	

Pre and post-operative comparisons of various patient reported outcomes: (Table 4)

There was statistically highly significant improvement in all the subjective scores of various patient reported outcomes from preoperative period after injury and at 3, 6 and 9 months post operatively as analysed using ANOVA test. TAMPA scale of kinesophobia also showed significant improvement with duration of time and which correlated with better patient satisfaction.

Table 4 Pre and post-operative comparisons of various patient reported outcomes.

		Std. deviation	ANOVA F VALUE	P VALUE
Lysholm	PRE OP 9 MONTHS	13.84281 9.07832	256.050	0.00
IKDC	PREOP 9 MONTHS	14.199 11.357	329.859	0.00
KOOS	PREOP 9 MONTHS	14.204 9.345	189.121	0.00
K-SES	PREOP 9 MONTHS	0.648 1.230	422.247	0.00
SF-36	PREOP 9 MONTHS	8.967 12.253	229.954	0.00
TAMPA	NO PREOP 9 MONTHS	8.599	175.965	0.00

Discussion

Clinical outcome after anterior cruciate ligament reconstruction have been studied numerous times, but the concept of knowing how much is your patient satisfied is emerging recently. There are only few studies which have been done on patient satisfaction and factors influencing them. Until now, clinical examination by surgeon on follow up and test being negative was assessment factor for clinician to be sure of good outcome of his surgery. Surgeon and the patient can have a different view regarding successful outcome after surgery (6).

Lysholm Tegner score and IKDC were more frequently used subjective scoring in many studies in determining clinical outcome. Recently in last 10 years it is observed that there are other factors which determines overall patient satisfaction. We searched in Cochrane and PubMed data bases for studies on patient satisfaction and could get only 12 articles related to patient satisfaction after primary ACL reconstruction and their relation to subjective or objective scores or both. We found out that subjective scores had significant impact on patient satisfaction. Scores which assessed psychological ability of the patient like K-SES which determines self-efficacy of the patient and TAMPA scale of kinesophobia which assess the fear of re-injury.

In our present study we tried to find out patient satisfaction following primary anterior cruciate ligament reconstruction in the patient were more significantly associated with patient satisfaction. SF-36 score which is the scoring for general overall health was also significantly related to patient satisfaction.

Lysholm, KOOS, and IKDC scores were also significant in determining patient satisfaction but on regression analysis only K-SES, TAMPA and SF-36 were best among them at the end of nine months.

A study by Arden et.al in 2016 showed that less satisfied group people had low self-efficacy scores and more fear of re-injury which also proved in our study. In our study many young active patients between 31-35 years played sports as regular hobby but none were professional sportsmen and participating in elite sports competitions. With this regards patients were very much satisfied with their knee function despite not actively returning to sports activity (7).

Patients above 40 years were few and none were playing sports and they were happy with surgery only because their symptoms of pain effusion and giving away are subsided. Patients from 18- 30 years were indulged in playing and wanted to return to playing again badly. At the end of 9 months most of them were able to jog and run and only few of them returned to sports again. Those who were not back into sports had low self-efficacy and more fear of reinjury.

Kocher.et.al in 2002 noted that pivot shift test positive patients on follow up were dissatisfied. In our study we had similar results at the end of 9 months where pivot shift test was significantly associated with patient satisfaction. In our study up to 90% patients had quadriceps weak and wasted in comparison to opposite knee but was not bearing significant association in patient satisfaction (8).

Christino et.al. 2016 concluded that self-esteem and locus of control in the patients play a pivotal role in the outcome after ACL reconstruction (9).

In this study we found that K-SES and TAMPA scale had significant effect on patient satisfaction and appropriate intervention can have positive effect on patient self-efficacy as advocated by Nyland.et.al (10).

Limitations

- The sample size was small.
- Intra operative factors like plica excision, tunnel placement was not considered but
- being a single surgeon operating on patients we believe to minimize the variations in
- the surgery among the patients.
- Patient satisfaction measuring instruments were not used.
- Pre-operative expectations were not considered.

Conclusion

Clinician determined factors are not enough in assessing patient satisfaction. Patients who reported higher subjective scores which assess psychological factors are found to be more helpful in determining patient satisfaction and final outcome after ACL reconstruction.

Acknowledgments

We are grateful for the support from Kasturba Medical College, Mangalore and Manipal Academy of Higher Education, Manipal.

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Italian experience with Prostatic Urethral Lift using pure local anaesthesia

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Abstract

Prostatic urethral lift (PUL) is a minimally invasive surgical treatment for obstructive lower urinary tract symptoms. We report the experience of two centres in Italy where PUL was performed under pure local anaesthetic. The procedure was well tolerated with no serious adverse events. Clinical outcomes at 1, 6 and 12 months were comparable with those reported in the literature.

Key words: Prostatic Urethral Lift, local anesthesia, minimally invasive treatment MIST, Benign prostatic hypertension BPH.

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Introduction

Benign prostatic hyperplasia affects over 500 million men worldwide. The resulting lower urinary tract symptoms (LUTS) are common in men and can impact significantly on quality of life and are associated with considerable economic burden. BPH affects over 40% of men in their 50s and over 80% of men in their 70s (1).

Treatment options for LUTS from BPH range from medication to surgery. Minimally-invasive surgical treatments (MISTS) are now available, which offer the patient greater choice in the management of their symptoms. MISTS have been shown to provide effective and durable symptom relief, quick recovery and low risk of complications or risk to sexual function (2-8).

MISTS also provide the opportunity to treat the patient in an ambulatory setting as a day case procedure. Across many surgical specialties, day surgery has been increasing. This increase has been largely driven by enhanced recovery programmes that encourage early mobilisation, advances in both anaesthesia and surgical techniques and a drive to reduce healthcare costs (9). Added to this, globally, the Covid-19 pandemic has put unprecedented strain on healthcare services. Recovery of these services has meant hospitals are seeking to redesign pathways and find new, more efficient ways of working to address the waiting list of patients, while also reducing the time patients are in hospital to as little as safely possible.

Developing effective local anaesthesia (LA) protocols for treating BPH with MISTs has a number of benefits (10). Surgical lists can be put together that comprise just procedures that are being performed under LA, thereby avoiding the need for an anaesthetist or recovery staff. Patients undergoing procedures under LA can transit directly to a secondary recovery area, enabling more efficient use of space and faster progression through the day surgery pathway.

Among the new MISTs for BPH, prostatic urethral lift (PUL) is one of the most widespread and well-studied procedures in the world (2-6). The reasons for its success are various: preservation of sexual function (3), rapid post-operative recovery (5), durable symptom relief in the long term (3), low complication rate (2, 3), low risk of catheterization compared to other MISTs (2, 7, 8).

Prostatic urethral lift (PUL) is performed using the UroLift® System. This system comprises the delivery device, which is inserted transurethrally through a rigid sheath under cystoscopic visualisation to reach the targeted area of obstruction. Each delivery device contains one UroLift implant, which are deployed by the delivery device to hold apart the obstructing prostatic lobes. Each implant is made with common implantable materials: nitinol, stainless steel, and PET suture.

The ability to perform PUL under pure LA without sedation is an important element in our surgical management of BPH, which reinforces the minimally invasive aspect of the procedure and helps to improve the speed of recovery for our patients. Here we report the results of the first Italian experience performing PUL under local anesthesia (LA). Our primary objective was to evaluate the tolerability of this procedure under LA, using the validated Visual Analogue Scale measurement instrument (VAS). We also collected clinical outcomes to compare with other clinical studies with PUL in the literature.

Methods

A prospective study was conducted with patients treated with PUL (Urolift® System) under LA, between November 2017 and September 2021 in two Italian centers. The only exclusion criteria was the presence of an obstructive median lobe seen during the initial cystoscopy or a prostate size greater than 90 ml.

Prior to the procedure, baseline measurements for maximum urinary flow rate (Qmax), post-void residual volume (PVR), and International Prostate Symptom Score (IPSS) were collected. Patients were also questioned about their sexual health using recognized questionnaires – MSHQ (Male Sexual Health Questionnaire) and IIEF-15 (International Index of Erectile Function).

In both centres, the procedure was performed in an endoscopy suite, using a set-up that would be typical of an outpatient setting. We followed a similar local anaesthesia protocol used by other units in Europe where prostatic urethral lift is being performed under LA. The LA protocol in this study was as follows:

1. 20 mins before the procedure: Intraurethral syringe injection of 20mg (2 vials) of cold lidocaine 2% (4oC; taken from the fridge), followed by an intraurethral injection of 2 tubes (15 g) of cold lubricant with lidocaine (Luan 2.5% Gel; 4oC taken from the fridge).
2. Penis clamp holds the anaesthetic and lubricant in place.

3. Patient is moved to the procedure room, placed into the lithotomy position and draped.
4. 2 further tubes (15 g) of cold lidocaine lubricant was added just before starting the procedure.

Medication administered during or following the procedure was:

- Midazolam/pethidine was available for use if required.
- Before starting the procedure, intravenous ciprofloxacin or ceftriaxone was administered intravenously.
- Ketorolac tromethamine/tramadol (Lixidol) 30 mg/ml was given to the patient during the procedure.
- If the pain score on the visual analogue scale (VAS) was >4, intravenous paracetamol was administered prior to discharge.

Pain scores were collected at the end of the procedure to assess the level of pain felt by the patient during the procedure under LA. Pain scores were assessed using the visual analogue scale (VAS); a validated, subjective measure for acute and chronic pain. To record the VAS score, the patient is asked to make a mark on a 10-cm line that represents a continuum between "no pain" and "worst pain." The patient marked the line in a place that best represents the level of pain felt during the PUL procedure.

Depending on which unit the patient was treated in, and in accordance with local pathways, the patient was either discharged the same day in one of the two centres or the following day in the other centre.

Follow-up visits were scheduled for 1, 6, 12, and 24, 36, 48 months postoperatively. Maximum urinary flow (Qmax), PVR, and IPSS were assessed at each follow-up visit to evaluate the effectiveness of PUL in reducing symptoms of BPH. During these visits, patients who did not have erectile dysfunction prior to PUL were questioned on changes in sexual function from their baseline reports. MSHQ and IIEF-15 questionnaires were also used to assess the impact of PUL on sexual function.

Results

A total of 55 patients were treated with PUL under pure LA. The procedures were performed by two surgeons. Baseline patient and procedural characteristics are provided in Table 1. Patients had a mean age of 67 years (range 50-87) and a mean prostate size of 45 mL (range 17-90). Twenty patients (36%) had severe BPH obstruction and had a previous episode of acute urinary retention (AUR) and/or urinary tract infection (UTI). None of the patients were in acute urinary retention at the time of the PUL procedure and all the PUL cases were scheduled elective procedures, with none performed as emergency procedures. Sixteen patients (29%) had a catheter at the time of procedure.

A mean of 3.6 (2–13) UroLift implants were implanted in procedures of an average of 16 minutes duration (range 8-60). Median length of hospital stay was 1 day (range 1-3), including the procedural day.

The average pain score recorded using the VAS was 3.7 ± 1.9. When asked whether the pain sensations had been higher, lower or the same during the PUL procedure compared with the preoperative cystoscopy, only 15% of the patients responded it was higher. In all cases there was a good tolerance to the procedure. One patient (1.8%) required intravenous midazolam (2 mg) due to agitation.

Following PUL, catheterization rate was 31.3%. Of those patients who were catheterized following the procedure, 86.6% were catheterized for 1 day (reason for catheterization: haematuria). The catheter was removed on the same day as the procedure in 4.4% of patients (reason for catheterization: mild haematuria). In 6.6 % of patients, the catheter was removed after 2 days (reason for

Table 1 Baseline Patient and Procedural Characteristics.
Qmax: maximum urinary flow rate (Qmax). PVR: post-void residual volume. IPSS: International Prostate Symptom Score. VAS: Visual Analogue Score. AUR: acute urinary retention. UTI: Urinary tract infection.

N (total)	**55**
Age (years)	67 (range 50-87)
Prostate size (ml)	45 (range 17-90)
Patients catheterised at time of intervention	16 (29%)
Prior episode of AUR and/or UTI	20 (36%)
Baseline IPSS	23.8 ± 4.3
Baseline Qmax (mL/sec)	6.8 ± 2.3
Baseline PVR (mL)	133 ± 59
Anaesthesia	100% LA*
*1 patients was given midazolam for agitation	
No. of implants per patient	Mean 3.6 (range 2-13)
Procedure duration (minutes)	16 (range 8-60)
VAS	3.7 ± 1.9
Post-op catheterisation	14%
Length of stay (days)	1 (range 1-3)

catheterization: acute urinary retention). One patient had a catheter for 5 days post-procedure (reason for catheterization: fever). All patients were catheter free at last follow-up.

Median follow up was 24 months (range 1-47). IPSS and Qmax improved over time, with durable improvement seen at 1 year (Table 2). At the latest follow-up, 52% of patients were satisfied and described experiencing complete symptoms relief. MSQH and IIEF-15 scores were available for 28 patients at the 1-year follow-up. Changes in the MSQH scores showed subjective improvement in ejaculation volume at suspension of alpha-blockers; minimal subjective improvement of erection quality. Changes in IIEF-15 scores increased from an average baseline of 12 (range 7-13) to 17 (range 7-20) at 1 month, 15 (range 9-18) at 6 months, and 14 (range 7-20) at 12 months.

No adverse events of Clavien–Dindo Grade > 2 was reported postoperatively. Sixteen patients had Grade 1 adverse events following the procedure, which were treated with analgesic medication. Grade 2 adverse events (urinary infection and fever following the procedure) were recorded in one patient.

Discussion

Prostatic urethral lift is a minimally invasive treatment option for men with LUTS from BPH, which can be performed under a local or general anaesthetic. We have reported our early experience in Italy of treating patients under pure LA. We found that performing PUL under pure LA was straightforward and was generally well tolerated by patients. VAS scores (average 3.8) were comparable with those reported from other units performing PUL under LA (4, 11) and comparable with VAS scores reported for cystoscopy (4).

Clinical outcomes were also comparable with those reported in the literature for PUL performed under both local and general anaesthetic (2-6), suggesting that performing PUL under LA does not adversely affect the expected improvements in symptoms. PUL was shown to have a good safety profile, with no worsening of sexual function observed.

Despite a high catheterization rate at baseline due to urinary retention, it was encouraging that all patients were catheter free by their last follow-up and most were catheter free by day 2 post procedure.

Conclusion

This early experience confirms that PUL when performed under LA is a well-tolerated, safe and effective approach for the treatment of LUTS due to bladder outlet obstruction. Clinical outcomes (IPSS and Qmax) from this real-world experience of treating patients with PUL reflects the peer-reviewed evidence from the early randomized controlled studies with PUL (2-4, 6). PUL is an attractive option for selected patients who seek rapid relief of LUTS with preservation of sexual function.

Table 2 IPSS, Qmax and PVR outcomes.
Qmax: maximum urinary flow rate (Qmax). PVR: post-void residual volume. IPSS: International Prostate Symptom Score.

Outcomes - IPSS	1 Month	6 Months	1 Year
N (total) - Paired subjects	48	35	26
IPSS Baseline	23.8 ± 4.5	23.7 ± 4.6	24.0 ± 4.5
IPSS Follow-up	14.6 ± 5.2	13.8 ± 5.7	13.5 ± 6.2
IPSS Change	-9.1 ± 5.8	-9.8 ± 6.6	-10.5 ± 6.7
p-value	p < 0.0001	p < 0.0001	p < 0.0001
Outcomes - Qmax	1 Month	6 Months	1 Year
N (total) - Paired subjects	31	22	17
Qmax (mL/sec) Baseline	6.6 ± 2.2	6.2 ± 2.3	6.5 ± 2.1
Qmax (mL/sec) Follow-up	14.8 ± 2.7	13.2 ± 2.2	12.3 ± 1.7
Qmax (mL/sec) Change	8.2 ± 2.4	6.9 ± 2.6	6.0 ± 2.2
p-value	p < 0.0001	p < 0.0001	p < 0.0001
Outcomes - PVR	1 Month	6 Months	1 Year
N (total) - Paired subjects	46	32	26
PVR (mL) Baseline	132.1 ± 61.7	139.8 ± 62.1	134.0 ± 60.3
PVR (mL) Follow-up	54.4 ± 31.7	57.3 ± 32.0	66.3 ± 32.1
PVR (mL) Change	-77.7 ± 53.4	-82.5 ± 55.1	-67.6 ± 56.5
p-value	p < 0.0001	p < 0.0001	p < 0.0001

Qmax: maximum urinary flow rate (Qmax). PVR: post-void residual volume. IPSS: International Prostate Symptom Score.

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Review of Local Anaesthetic Systemic Toxicity for Physicians and Surgeons in the Ambulatory Care Setting

B Cirella, RJ Miller, SR Dennison Jr.

Abstract

Upon review of the literature, we found it to be concerning that there was minimal literature regarding the resuscitation from local anesthetic systemic toxicity in an ambulatory care setting. On a daily basis surgeons and physicians (MD, DO, DPM, DDS, DMD) administer local anesthetic and should be aware of the checklists and steps to resuscitate a patient that may have toxicity. There have been major developments with administrating 20% lipid emulsion to reverse the toxicity one may have from local anesthetics. It is strongly recommended that physicians be BCLS and ACLS certified, perform a good physical diagnosis, and have lipid emulsion therapy readily available in every clinical/hospital/ambulatory surgical setting. In this journal review article, we have provided checklists/steps to follow in case a patient has signs and symptoms of local anesthetic systemic toxicity. The majority of local anesthetic toxicities do occur with upper extremity and neuraxial blockade however there is still a reduced risk of lower extremity local anesthetic systematic toxicity.

Key words: Local Anesthetics, Lipid Emulsion, LASTH.

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We found there to be minimal information regarding resuscitation from local anesthetic systemic toxicity (LAST). We found this to be concerning in the situation of a physician and/or surgeon (MD, DO, DPM, DDS, DMD) knowing how to quickly resuscitate a patient. Approximately 83% of procedures performed in-office/hospital/ambulatory surgical center (ASC) requires local anesthetic and the remaining 17% of procedures require general anesthesia. According to the American Society of Regional Anesthesia (ASRA), there is a checklist that is helpful to us and is useful during times of stress when a patient unexpectedly shows signs of severe local anesthetic toxicity. Overdose of intravascular injection of local anesthetics is associated with cardiac toxicity according to the Anesthesia Patient Safety Foundation (APSF). Primary systemic toxicity usually occurs in the central nervous system (CNS), which will initially cause tremors/convulsions. The cardiac toxicity is characterized by atrioventricular conduction delay, hypotension, with ultimately cardiovascular failure. There have been major developments in understanding treatments for LAST including early administration of lipid emulsion therapy. All physicians and medical professionals should be familiar with signs and treatment of local anesthetic toxicity.

The typical adverse effects due to local anesthetic systemic toxicity most often involves the central nervous system, cardiovascular system (CVS), and haematological system (5). Indicators of LAST usually show around 1 to 5 minutes after anesthetic injection. There may be a delayed manifestations of last which may appear 60 minutes after injection. In Table 1, according to the article based off Local Anesthetic Systemic Toxicity there is a list of signs and symptoms that associate with the systems being affected (3). Below in Table 1, The Regional Anesthesia Pain Medicine journal states the initial presentation of CVS symptoms only is about 24%, CNS symptoms only is 43%, and CNS + CVS together is 33%.

Onset of local anesthetic toxicity is very rapid and potentially fatal, which is most commonly associated with the administration of therapeutic error. There are several types of factors that are associated with administration and the type of drug being used. To achieve the anticipated duration and range of anesthesia, the local anesthetic should be given at the lowest dose that can achieve these two goals. The serum concentration is induced by the dose, method of administration and the site. Local anesthetics may be injected, inhaled, administrated endotracheal tube, or applied topically to skin. The two critical factors for the administration for local anesthetic that should be known is the patient's weight and the concentration of the local anesthetic that is being administered. Table 2 is a reference for the maximum recommended dosages with and without epinephrine for local anesthetic administration (3).

Most adverse effects usually occur within 1 minute of administration of the local anesthetic. However, there can be a delayed onset of greater than 1 hour after the administration of the local anesthetic demonstrating toxicity. Some situations there can be a delayed onset greater than 1 hour. Another variable that can increase the chances

Table 1 Manifestations of the CNS, CVS, and Hematologic systems due to Local Anesthetic Systemic Toxicity.

Central Nervous System (CNS)	Cardiovascular (CVS)	Haematological
• Disorientation	• Chest pain	• Cyanosis
• Drowsiness	• Diaphoresis	• Tachypnea
• Metallic taste	• Shortness of breath	• Dizziness and syncope
• Convulsions	• Palpitations	• Weakness
• Muscle twitching	• Bradycardia	• Fatigue
• Coma	• AV Block	
• Respiratory depression and arrest	• Hypotension	
• Agitation	• Cardiac arrest	
	• Tachyarrhythmias	

Table 2 Suggested recommendations for commonly used local anesthetic agents.

Local anesthetic	Plain		With epinephrine	
	Maximum dose	Maximum dose	Maximum dose	Maximum dose
Bupivacaine	2 mg-kg^{-1}	175 mg	3 mg-kg^{-1}	225 mg
Levobupivacaine	2 mg-kg^{-1}	200 mg	3 mg-kg^{-1}	225 mg
Lidocaine		350 mg	7 mg-kg^{-1}	500 mg
Mepivacaine	5 mg-kg^{-1}	350 mg	7 mg-kg^{-1}	500 mg
Ropivacaine	3 mg-kg^{-1}	200 mg	3 mg-kg^{-1}	250 mg
Prilocaine	6 mg-kg^{-1}	400 mg	8 mg-kg^{-1}	600 mg

of LAST is dependent on which local anesthetic is used. The more lipophilic of the local anesthetic, the increased chances of toxicity. According to the choices of drugs in Table 3, for example, bupivacaine is more lipid soluble than mepivacaine. The dosage of administration is substantially less due to it being more potent, which can result in an amplified occurrence of local toxicity. Lastly, according to the American Heart Association (AHA), epinephrine is typically added to low doses of local anesthetic solution to reduce the systemic absorption and maximum local anesthetic plasma concentrations.

Table 3 Relative Potencies of Local Anesthetics .

Agent	Relative Clinical Potency
Procaine	Low
Lidocaine	Moderate
Mepivacaine	Moderate
Levobupivacaine	High
Bupivacaine	High
Ropivacaine	High

Most anesthetics are administered through peripheral nerve blocks, spinal/neuroaxial anesthesia, and combined spinal epidural (CSE). Peripheral nerve blocks are the most common route of administration of local anesthetics in a clinical setting. Physicians are urged to be equipped and prepared for LAST treatment. Advanced cardiac life support and administration of 20% lipid emulsion are the mainstay treatment remedies for LAST. According to intravenous lipid emulsion in clinical toxicology journal, they state that 20% Intralipid formula consists of 20% soybean oil, 1.2% egg yolk phospholipids, 2.25% glycerin, water, and sodium hydroxide (1). For example, Henry Schein, sells a case of 12 of 20% Lipid Emulsion 500mL for the price of $222.17. The shelf life for lipid emulsion is 24 months. This treatment choice is recommended for physicians to have readily available for emergency use in clinical setting. The 20% lipid emulsion offered by Henry Schein is less expensive than paying attorney fees for a malpractice claim. The American Society of Regional Anesthesia (ASRA), Figure 1, (near here) has developed a procedure checklist to be followed for the stabilization of a patient undergoing local anesthetic systemic toxicity (6).

There are multiple theories describing how local anesthetic systemic toxicity affect the body, but one major affect is the mitochondrial oxidative-phosphorylation pathway. Essentially the local anesthetic toxicity disables cells from regenerating ATP for energy. Without the energy production of ATP for major organs such as the heart, lungs, and brain, normal conduction is disrupted & then we see the symptoms of LAST-induced arrest. This is when one would administer the 20% lipid emulsion which has a mechanism of action by a protein type lipid mechanism that acts like a sink that draws in local anesthetic and binds it up. Local anesthetics for example, bupivacaine, are very lipophilic meaning they are able to dissolve or combine with lipids and/or fats. When a patient undergoes toxicity, the lipid emulsion is administered which begins to make a lipid compartment in the blood stream called a "lipid sink" or lipid reservoir (1). The local anesthetics are then drawn away from areas with high plasma concentrations/ high perfusion tissues such as the heart, lungs, and brain to the lipid reservoir compartment. Once the local anesthetic is drawn to the lipid reservoir, it is then reallocated to liver for detoxification and muscle for storage (4). The lipid compartment works rapidly and has been indicated to improve the cardiac output and blood pressure.

The Anesthesia Patient Safety Foundation (APSF) and the AHA suggest the use of cardiac arrest drugs such as high-dose epinephrine can be counterproductive in treatment of LAST (6). Therefore, the AHA and APSF recommends using the lowest dose of epinephrine in local anesthetic solution, because epinephrine could be used later in higher doses if one were to have LAST reaction (2). After the patient is successfully resuscitated and stabilized from local anesthetic toxicity, the patient should be admitted to the intensive care setting for 24 hours of monitoring and re-evaluated. Cardiology, Nephrology, and Neurology and other medical specialties as needed should be consulted to check so there are no residual cardiac, renal, or neurological dysfunctions, etc.

The best prevention and treatment for local anesthetic toxicity on the market currently today is the immediate availability of 20% of lipid for immediate resuscitation of local anesthetic toxicity (5). These resources are efficient and readily available to every physician. It is strongly recommended for physicians to be BCLS and ACLS certified per facility requirements. BCLS and ACLS trained physician along with readily available 20% lipid emulsion and the low dose administration of the less potent local anesthetics all combined to provide a reasonable margin of safety for the patient (6).

Physicians are urged to perform a good physical diagnosis and patient selection for surgical procedures involving local anesthetics. Physicians and surgeons should be intimately aware that they are treating the whole patient systemically and not just the surgical site. Physicians and surgeons are urged to be aware of local anesthetic toxicity and the treatment modality for the local anesthetic toxicity.

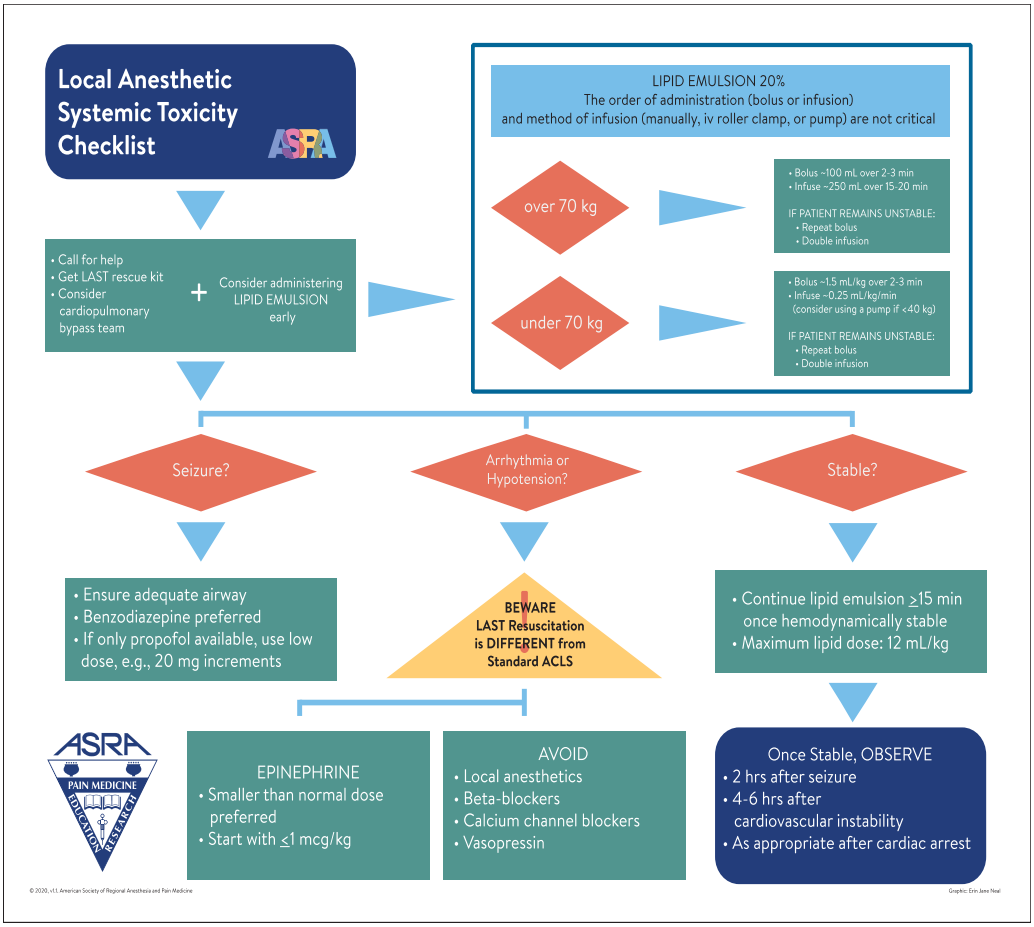

Figure 1 Step by step checklist to treat local anesthetic systemic toxicity.

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