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- Title
- Abstract
- Introduction
- Methods
- Results
- Discussions
- Conclusion
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Editorial

The Kenya Journal of Anaesthesia and Critical Care Medicine moves on to the third edition significantly supported by the KSA and CCSK faculty. Patient safety remains the main anaesthetic practice agenda across all surgical specialties with intent to avoidance of adverse outcomes and complications.

The acceptance and benefits of regional anaesthesia in obstetric practice are well documented. The practice however also has fairly common and probably benign and acutely manageable complications such as hypotension and to some irritatingly postdural puncture headache (PDPH). Occasionally unexpected and clinically diagnostic challenges may manifest beyond rational application of otherwise routine sub arachnoid procedures. In this edition, a case of an extradural haematoma post subarachnoid block for a caesarean section is presented. This highlights the need for more in-depth preoperative risk profiling, acute awareness of complications and multidisciplinary interventions in order to enhance positive outcomes.

Routine or otherwise traditional management of postoperative pain is a rapidly changing field of practice. Multimodal analgesic combinations have been the main stay of abdominal surgical access. Regional anaesthesia has largely been limited to the use of local infiltration and occasionally epidural approaches. The advent of the clinical application of ultra-sonography beyond diagnostic and interventional radiology has also helped create new modalities in anaesthesia practice for facilitation of amongst other things, perioperative analgesia. The transverse abdominal plexus block is one such approach that has been facilitated by ultra-sonographic guidance and easily adopted safely with lower technical demands. This high impact regional approach essentially should form part of our armamentarium in analgesic provision.

Safe use and clinical application of a myriad of airway devices is important in anaesthesia, critical care and resuscitation. There has been a constant search for easily applicable protocols devoid of complications. Population dynamics and variants demand customisation of clinical applications associated with the use of these tools. Safe removal of the laryngeal mask airway (LMA) is one of the features highlighted in this journal issue from a local study.

Emergence delirium post anaesthesia is a distressing topic across both caregivers and relatives: the causes of delirium must be addressed when related to organic reasons: where no organic reason can be identified and addressed, its management remains a challenge. Adeno-tonsillectomy remains a common surgical intervention whose outcome may also have delirium as a common adversity. Trial of the use of short acting low dose opiates has been highlighted here in search of patient care and comfort indices.

Lastly, a society cannot afford not to know its history nor pay homage to those that have played a big role in its development. The training of physician anaesthesiologists has been ongoing in Kenya for over thirty years and in this journal edition, we fittingly pay tribute to a pioneer lecturer recently departed.

Fentanyl Administered Ten Minutes To The End Of Surgery Prevents Emergence Delirium Among Children Undergoing Adeno-Tonsillectomy At Kenyatta National Hospital: A Randomized Double Blind Placebo Controlled Clinical Trial

Dr. Kirwa. K.E. Dr. Gacii.M. Dr. Osoti. A. Dr. Mutio. E, and Dr.Onchiri F

Abstract

Background

Use of modern volatile, insoluble inhalational anaesthetic agents has been associated with increased incidence of emergence delirium (ED) in children undergoing general anaesthesia, Fentanyl has been used to prevent ED after sevoflurane anaesthesia in advanced centers. In the low resource setting, the use of halothane and isoflurane in induction and maintenance of anaesthesia respectively, is common practice and there are limited studies to determine the incidence of ED and whether use of fentanyl towards the end of surgery helps prevent it.

Purpose

The aim of this study was to find out the incidence of ED using the Watcha scale and the impact of giving Fentanyl ten minutes before the end of surgery including its effect on emergence time and other related immediate complications in children undergoing adeno-tonsillectomy under halothane and isoflurane anaesthesia in Kenyatta National hospital.

Methods

In this randomized double blind placebo controlled clinical trial, 110 children aged between 1-12 years undergoing adeno-tonsillectomy in Kenyatta National hospital under halothane and isoflurane anaesthesia where randomized to the intervention group comprising Fentanyl given at a dose of 1ug/kg or the control group comprising normal saline. The treatment was administered approximately ten minutes to the end of surgery: the incidence of ED was assessed at the recovery room using the Watcha scale, the time to complete recovery. The effectiveness of fentanyl in preventing ED was evaluated as was the occurrence of immediate complications at recovery room assessed in the two groups.

Results

The incidence of ED was lower among children randomized to receive Fentanyl compared to those in the control (14.6% vs. 47.3%; p<0.001). The intervention was associated with 81% reduction in the risk of Emergence delirium (OR=0.190; 95% CI: 0.076-0.475, p<0.001). This effect persisted in the multivariate analysis that adjusted for the imbalances in the covariates (OR=0.184; 95% CI: 0.070-0.479; p<0.001). There were no statistical difference in the average time to full recovery between the patients randomized to receive fentanyl and those randomized to control (25.2 vs. 22.6; p=0.189) and majority of the patients in both arms; 96.4% in control and 94.6% in fentanyl group did not experience any immediate complications.

Conclusion

We found that the incidence of Emergence delirium in control group was much higher than in fentanyl group (47.3% vs 14.6%) and the use of fentanyl significantly reduced the risk of incidence of emergence delirium by 81% with no statistically significant difference in the average time to full recovery (25.2 vs. 22.6; p=0.189) and immediate complications in children (1-12 years) undergoing adeno-tonsillectomy at Kenyatta National Hospital.

Background

Emergence delirium (ED) also known as emergence agitation is a common post-operative dissociative behaviour observed in children after undergoing general anaesthesia (GA) using modern highly potent inhalational anaesthetics. The aetiology of ED remains largely unknown, factors contributing to its development include; sudden emergence from general anaesthesia into a disordered state of consciousness or into an unfamiliar environment, Elevated postoperative pain, use of modern volatile anaesthetics and type of surgeries e.g. ear nose and throat (ENT) surgical procedures have been shown to have higher incidences of ED.[2, 9, 14.]

ED has been well studied and described as the most common immediate complication in children undergoing general anaesthesia under sevoflurane and desflurane but few studies have shown its occurrence in halothane and none in isoflurane anesthesia.[37]

ED lasts between 5-15 minutes and its effects are devastating and contribute to increased morbidity and mortality in the post-operative period as children will pull out the drains, remove intravenous access, bleed and leads to overall dissatisfaction[38]. The signs and symptoms associated with ED include irritability, non-cooperation and thrashing. The children become inconsolable or uncompromising, incoherent, experience paranoid ideation and unable to recognize and

identify familiar and known objects or people.[2, 36]

The incidence of ED varies from 10-80% on use of sevoflurane[10, 13, 35,] we do not have the incidence in our region where we use halothane and isoflurane frequently hence the need for this study.

There are various scales for assessing ED with each having its advantages and disadvantages but correlate reasonably well, this study utilizes the Watcha scale which is a simpler tool to use in clinical practice and has higher overall sensitivity and specificity[1]

Prevention is the best strategy in management of ED since its experience may increase the incidence of new-onset postoperative maladaptive behavioural changes such as general anxiety, night-time crying, enuresis, separation anxiety, and temper tantrums for up to 14 days after surgery. Preventive measures which have been studied with varied results include the co-administration of Propofol, sedatives, opioids and 2-adrenoreceptor agonists such as clonidine. The effectiveness of these agents in prevention of ED varies in different set ups.[3, 5,19,20,21,22,27,32]

The purpose of this randomized control double blind clinical trial is to determine the incidence of ED using Watcha scale in children aged 1-12yr undergoing adeno-tonsillectomy under halothane and isoflurane at Kenyatta National Hospital, evaluate use of fentanyl given approximately 10 minutes to end of surgery in prevention of ED, find out if the use of fentanyl prolongs emergence time from general anesthesia and assess its immediate complications at the recovery room.

Methods

This clinical trial was approved by Kenyatta National Hospital/ University of Nairobi Ethics and Research committee (reference P628/10/2015) and was registered with the clinicaltrials.gov (trial No. NCT02753725). All participations were voluntary with written informed consent obtained from parents and guardians of all the participants.110 children aged between 1-12 years old and of ASA class 1 and 2 undergoing adenoidectomy or tonsillectomy or both under halothane and isoflurane anaesthesia where prospectively selected to participate in the study. Exclusion criteria included children with genetic syndromes, psychological/ neurological behavioural disorders, allergies to Fentanyl, psychiatric disorders/ use of psychiatric medications, the use of sedative medications one hour prior to surgery, developmental delay, coming in as day case, airway problems not related to the surgery-sleep apnoea, age less than 1 year or above 13 years. The paediatric fasting guidelines were observed for all participants.

Selected participants were randomly assigned to either study arm of fentanyl 1ug/kg or control arm of normal saline equal to the volume of fentanyl in a double blinded manner according to computer generated random numbers. The agents used in this study where prepared in 1cc syringe by a research assistant (pharmacist) who was not involved in administration of the treatment or data collection.

Participants were not premedicated prior to induction.in the operating room standard monitors (ECG, SPo2, Non-invasive blood pressure and capnography were used). Anaesthesia was induced by nitrous oxide/oxygen (50%:50%) and halothane 1-3% and maintained with isoflurane 0.8-1.5%, during induction: children were calmed down by reassurance to accept mask. After loss of consciousness and intravenous access establishment, Atracurium 0.5mg/kg was given to facilitate endotracheal intubation with appropriate endotracheal tube for age. Fentanyl 2ug was given(except for two patients in the control group and four in the study arm due to an personal decisions by the anaesthesia provider) as were a standard antiemetic and antibiotic was given to each child. multi modal analgesia approach with more than two classes of analgesics where given to each child. Ventilation was controlled and monitored using end tidal carbon dioxide maintained between 30-40mmHg.

Approximately ten minutes to end of surgery when the mouth gag was removed, Those randomized to the intervention arm received intravenous Fentanyl at 1ug/kg and Those randomized to the placebo arm will receive intravenous normal saline at a volume equivalent to fentanyl dose of 1ug/kg using 1cc syringe. The induction agents, analgesics and any other medications administered during the course of surgery will be recorded, after surgery children were reversed by switching off isoflurane and nitrous oxide, giving 100% oxygen, giving neostigmine 0.04mg/kg, atropine 0.02mg/kg and trachea extubated when fully awake. The time of treatment administration and time of fully emergence from anaesthesia defined as when the patient displays facial grimacing, purposeful movements, regular breathing pattern and eye opening, will be recorded and analysed.

The children where moved to recovery room after full emergence from anaesthesia was established, the blinded principal investigator only filled the research questionnaire and sored for ED to prevent inter rater variability at the recovery room and monitored for presence of ED in the first 20 minutes using Watcha scale. Children who develop ED during the study were treated with Propofol (0.5 mg/kg IV).

Statistical Analysis

The incidence of ED from previous studies varies from 10-80%, as per our power analysis we would need a sample size of 49 children per group to) to achieve 80% power to detect the stated difference of 20% at a two-sided alpha=0.05 level of significance. This study utilized 55 respondents in each group to provide for 10% attrition. Demographic, clinical and laboratory characteristics were summarized and compared between study arms. Continuous variables were summarized using means (and standard deviations) and compared using the two-sample t-test if normality assumptions are

met; otherwise they were summarized using medians and interquartile ranges and compared using nonparametric Wilcoxon rank sum test. Categorical variables were summarized using counts and proportions and compared between study groups using Pearson's chi-square tests or Fisher's exact tests as appropriate. To determine the effect of the intervention on ED we compared the incidence of children with ED between children randomized to the intervention and the control arms. Odds associating intervention with intervention were estimated using univariate and multivariate logistic regression models. Adjusted odds ratios (aORs) and their 95% confidence intervals (CIs) were computed.

Results

All 110 children recruited completed the study.

The demographic and clinical characteristics of the study participants are presented in Table 1. Except for weight and use of tramadol analgesic, the distributions of the rest of the characteristics were statistically similar between the study arms. The effect of the intervention on ED persisted in the multivariate analysis that adjusted for the imbalances in the covariates.

The incidence of ED was significantly lower among children randomized to receive Fentanyl compared to those in the control (14.6% vs. 47.3%; p<0.001). The results of the regression analyses of the effect of the intervention are presented in table 2. In the univariate logistic regression, the intervention was associated with a statistically significant 81% reduced risk of Emergence delirium (OR=0.190; 95% CI: 0.076- 0.475, p<0.001). This effect of the intervention on ED persisted in the multivariate analysis that adjusted for the imbalances in the covariates observed in Table 1 (OR=0.184; 95% CI: 0.070-0.479; p<0.001).

Table 1: Demographic and Clinical Characteristics

Variable	Arm		
	Control (n=55)	**Study Arm (n=55)**	**p-value**
Age (yrs.), mean (SD)	4.1 (2.3)	4.6 (2.2)	0.29
Gender			
Female	25 (45%)	23 (42%)	0.70
Male	30 (55%)	32 (58%)	
Weight (Kg), Mean (SD)	15.7 (5.7)	18.0 (5.3)	0.030
Type of surgery			
Adenoidectomy	20 (36%)	12 (22%)	0.24
Adenotonsillectomy	33 (60%)	40 (73%)	
Tonsillectomy	2 (4%)	3 (5%)	
Tramadol analgesic used?			
No	28 (51%)	17 (31%)	0.033
Yes	27 (49%)	38 (69%)	
Tramadol dose used[mg], Mean (SD)	25.4 (26.7)	19.8 (7.7)	0.23
Diclofenac analgesic used?			
No	52 (95%)	55 (100%)	0.24
Yes	3 (5%)	0 (0%)	
Fentanyl analgesic use at induction?			
No	2 (4%)	4 (7%)	0.40
Yes	53 (96%)	51 (93%)	
Fentanyl dose used [mcg], Mean (SD)	15.4 (7.9)	16.7 (8.3)	0.43
Paracetamol analgesic used?			
Yes	55 (100%)	55 (100%)	
Paracetamol dose used[mg], mean (SD)	241.3 (101.9)	264.4 (125.2)	0.29

Table 2: Analysis of the effect of intervention on Emergence delirium(ED)

	Unadjusted Analysis			**Adjusted Analysis**		
	RR	**95% CI**	**p-value**	**RR**	**95% CI**	**p-value**
Study_Arm2						
Control*	1			1		
Study Arm	0.190	(0.076-0.475)	<0.001	4	(0.070-0.479)	<0.001
Sex						
Female*				1		
				0.99		
Male				8	(0.414-2.419)	0.999
Type of surgery						
Adenoidecto-my or Tonsil-lectomy*				1		
				0.59		
Adenotonsil-lectomy				6	(0.235-1.514)	0.277
				0.89		
Age(yrs)				1	(0.657-1.209)	0.460
				1.05		
Weight (Kg)				3	(0.933-1.189)	0.399

Table 3: The incidence of ED was significantly lower among children randomized to receive Fentanyl compared to those in the control (14.6% vs. 47.3%; p<0.001).

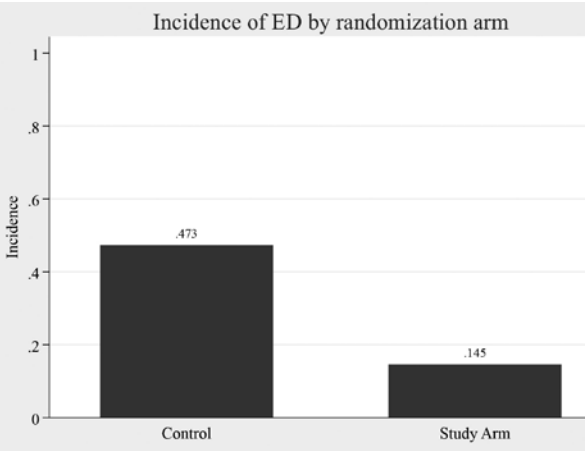

Table 4. There was no evidence that the effect of fentanyl on ED was different between the male and females. The interaction term of intervention and gender was not significant; p=0.782.

Covariate	Odds Ratio	95% Conf. Interval	P>|z|
Study_Arm2			
Control*	1		
Study Arm	0.163	(0.038-0.689)	0.014
Sex			
Female*	1		
Male	0.948	(0.327-2.744)	0.921
Study_Arm2 & Sex interaction			
Study Arm & Male	1.302	(0.200-8.487)	0.782
Baseline category			

Table 5. The incidence of ED by randomization and gender

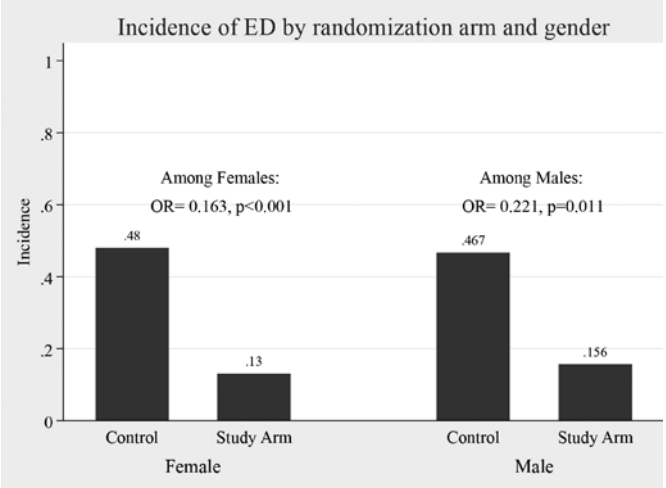

Table 6 : Duration of emergence by study arm, There were no statistically significant difference in the average time to full recovery between the patients randomized to receive fentanyl and those randomized to control (25.2 vs. 22.6; p=0.189).

	Study arm		
Factor	Control (n=55)	Fentanyl (n=55)	p-value
Duration of emergence [Min], Mean (SD)	22.6 (9.3)	25.2 (10.6)	0.189

Table 7. complications experienced at recovery, majority of the patients in both arms; 96.4% in control and 94.6% in fentanyl group did not have any complications.

Factor	Control	Fentanyl	p-value
N	55	55	
Complications after reversal			0.50
LARYNGOSPASMS	2 (4%)	2(4%)	
POST OPERATIVE NAUSEA AND VOMITING	0 (0%)	1 (2%)	

Discussion

This study showed that there is increased incidence of ED in the control group compared to the fentanyl group 47.3% vs 14.6% (p<0.001) in children undergoing general anesthesia under halothane and isoflurane. Hanny M.Yassin, Maged L.Boules39 found the incidence of 46.9% in control group and 12.5% in fentanyl group using pediatric anaesthesia emergence delirium scale (PAED scale) in children undergoing inguinal hernia repair under sevoflurane anesthesia, this correlates well with our findings. Welborn L.G, Hannallah R.S, and Norden J.M et al9 described the incidence of ED ranges from 10-80% depending on the scale used and the type of surgery involved.

Studies have associated ED with use of sevoflurane but in our setting we mostly use halothane and isoflurane and this study showed that use of halothane and isoflurane is also associated with comparable increased incidence of ED whose aetiology in children is still largely unknown. Sevoflurane has been well studied in association with ED.2, 6, 7

ED has been observed in children undergoing painless procedures under inhalational agents and ideally immediate postoperative pain should be ruled out while determining the presence of ED, in this study all children under going adeno-tonsillectomy, pain was adequately managed by use of multimodal analgesics during surgery. Patients undergoing this kind of surgery usually experience moderate pain which is usually well controlled by two analgesics of different modes of action, therefore severe post-operative pain was not expected in this study 2, 7

Fentanyl is short acting opioid analgesics whose effects in reducing the incidence of ED have been shown: this study found out that use of fentanyl significantly reduced the incidence of ED in children undergoing adeno-tonsillectomy under halothane and isoflurane compared to the control group. Fentanyl has been shown to prevent ED independent of its analgesic properties in sevoflurane anaesthesia21, 24, Cravero JP, Thyr B, Beach M5 found that use of 1microgram per kilogram of fentanyl ten minutes to stoppage of sevoflurane anaesthesia is effective in reducing ED from 56% to 12%. The univariate logistic regression of our study shows that the intervention was associated with a statistically significant 81% reduced risk of Emergence delirium (OR=0.190; 95% CI: 0.076- 0.475, p<0.001). This effect of the intervention on ED persisted in the multivariate analysis that adjusted for the imbalances in the covariates observed in Table 1 (OR=0.184; 95% CI: 0.070-0.479; p<0.001).

This study found out that there is no difference in emergence time from anaesthesia between the two treatment arms and confirms that fentanyl use prior to reversal from general anesthesia does not prolong the emergence time. Pattaravit N, Oofuwong M, Klaina S, et al.21

This study also looked at the immediate postoperative complications during reversal from general anaesthesia and recovery period in the recovery room and found out that there was no difference in terms of development of laryngospasms in the two groups. However, the fentanyl group had an incident of immediate nausea and vomiting though not statistically significant. Kim MS, Moon BE Kim H et al34 found increased incidence of postoperative nausea and vomiting with use of fentanyl to prevent ED as expected when using opioids due to their increased risk of nausea and vomiting and that use of standard antiemetic prophylaxis greatly reduced the occurrence of this complication and thus use of antiemetics while using fentanyl to prevent ED should be encouraged due to the risk of increased incidence of postoperative nausea and vomiting.

This study also found out that there was no interaction between the gender and the incidence of ED, in the control group there was no statistical difference between development of ED in the female and the male gender (48% vs 46.7%) whereas the fentanyl group also showed no statistical difference in Incidence of ED between female and the male gender (13% vs 15.6%). The fentanyl group had significantly lower incidence of ED in both gender, the males control group had higher incidence of ED than control group (46.7 % vs 15.6% p<0.001) while females had significantly lower incidence of ED in fentanyl group than the control group (48% vs 13% p<0.001), this indicates that the occurrence of ED is equal across male and females and gender doesn't play any role in its occurrence, it also indicates that the effect of intervention is effective across both gender.

However this study has a few limitations in that we never followed children past recovery room to determine whether there was any significant differences in the two groups thereafter in terms of late development of nausea and vomiting. The study also did not assess pre-operative anxiety levels of children which has been shown to increase the incidence of ED since children on sedatives were excluded from the study. The significant difference in incidence of ED between the fentanyl group and control group (14.6% vs. 47.3%; p<0.001) and the fact that fentanyl significantly reduced the incidence of ED by 81% confirmed to us that there is high incidence of ED in use of halothane and isoflurane and fentanyl given prior to the end of surgery prevent ED.

In conclusion we found that there is increased incidence of Emergence delirium in control group compared to fentanyl group (47.3% Vs14.6%) in children undergoing general anaesthesia under halothane and isoflurane and the use of fentanyl significantly reduced the risk of incidence of emergence delirium by 81% with no statistically significant difference in the average time to full recovery (25.2 vs. 22.6; p=0.189) and occurrence of immediate complications in children (1-12 years) undergoing adeno-tonsillectomy at Kenyatta National Hospital.

Declaration of Interest
None

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Impact Of Deep Versus Awake Laryngeal Mask Airway Removal On Airway Complications In Spontaneously Breathing Adult Patients Following Isoflurane General Anesthesia

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Abstract

Background

Objectives

Primary Objective: To compare the impact of having LMA removal deep versus awake on the occurrence of airway complications following general anaesthesia in spontaneously breathing adult patients using Isoflurane as the sole volatile agent.

Secondary Objective: To compare the impact of deep versus awake LMA removal on anaesthesia theatre turn-around time.

Study Setting: The Aga Khan University Hospital, Nairobi, Kenya.

Study Design: A prospective randomized control trial (open).

Sample Size: A sample size of 116 participants, 58 in each arm.

Study Population: ASA I and II patients aged 18-65 years scheduled for theatre for low to moderate risk, non-emergent surgery.

Data collection: Parameters of interest being; Airway obstruction requiring airway manipulation, laryngospasm, desaturation to 90% or less on pulse oximetry, all of which were composited to define 'airway complication'. Time to theatre exit after attaining an end tidal of 1.15% Isoflurane.

Results

116 ASA I & II patients scheduled to undergo elective surgery were included in this study, 58 (50%) subjects in the awake arm and 58 (50%) subjects in the deep arm. Baseline demographic characteristics were similar between the groups.

More airway complications were encountered in the Deep arm - 13 (22.4%) relative to the Awake arm -5 (8.6%), this was found to be statistically and clinically significant, P value P=0.040, odds ratio 3.0622; 95% CI, 1.0139 to 9.2483.

Conclusion

The study concludes that there is a significant difference in the occurrence of airway complications when the laryngeal mask airway is removed deep (anaesthetized) compared to awake (appropriate response to command). In this regard, the removal of the LMA while the patient is still deeply anaesthetised is not as safe as or safer than awake laryngeal mask airway removal.

Introduction

The Laryngeal Mask Airway (LMA) is a supra-glottic airway management device invented in 1981 by Archie Brain, an anaesthesiologist (5). Its invention marked a turning point in airway management in anaesthesia as it offered a convenient bridge between the use of an endotracheal tube and facemask ventilation.

A meta-analysis by J. Brimacombe et al found that the LMA had thirteen advantages over the endotracheal tube and four over the face mask as techniques of airway management(6). They also noted that the LMA had two disadvantages over the endotracheal tube and one over the facemask(6). Of the advantages, ease of use is a prominent feature of the LMA. This relative ease of use and safety profile has led to the utilization of an estimated 200 million LMAs globally as of 2013(7).

The utilization of the LMA can be anticipated to increase given the current use of the device in procedures previously deemed as contraindications.

For instance, several publications report use in surgery performed in prone position, airway surgery such as adeno-tonsillectomy, laparoscopy(8–10). The expanding scope of use can be viewed as an attempt to reap the advantages of the device cited in other areas of application. The LMA can be considered to be a relatively new invention, as such, certain aspects of its use remain unsettled and research towards clarifying and improving these aspects is ongoing. Whether to remove the LMA when patient is "awake" (appropriate response to command) or "deep" (anesthetized), is one such area. The manufacturer of the AuraOnce™ LMA (Ambu®) recommends that the LMA be removed once the patient is fully awake and protective airway reflexes are active(11). This recommendation was also put forth by the inventor Archie Brain(5) in 1983. There appears to be no objective evidence in support of these recommendations, as such, use of the LMA over the past 25 years has led to several studies to substantiate this recommendation. This gap in knowledge is summarized in the conclusion of a Cochrane systematic review by Mathew P.J. et al, that current evidence does not show superiority of either approach(12). This study set out to determine the proportion of airway complications occurring in awake versus deep (anaesthetized) patients undergoing anaesthesia at the Aga Khan University Hospital, Nairobi. The ultimate aim was to distinctly quantify the proportion of airway complications associated with either approach thus aid decision making on safe use of the LMA. Moreover, increased knowledge

on safe practice has implications on efficiency and healthcare costs both direct and indirect as regards formulation and use of guidelines, resource allocation (i.e. cadre of human resource required to safely deploy, use & remove the device) and time management (i.e. theatre turnaround time)(17).

Methodology

Study Population

All patients scheduled to receive general anaesthesia with a laryngeal mask airway (as the airway management device) for elective, low to moderate risk surgery in supine or lithotomy positions.

Recruitment Procedure

Patients were recruited from the day-care unit. Patients were informed of the nature of the study, screened for eligibility and recruited if eligible. Eligible patients had oral explanations on the purpose and nature of the study. The patients who gave written Informed Consent were enrolled into the study.

Randomization

The statistician developed a simple random allocation sequence using a computer algorithm. Each of the random numbers were sequentially assigned to either; Awake arm: Green sticker; Deep arm: Red sticker.

The statistician serialized envelops to correspond to the random allocation sequence and insert the green and red stickers in them. Patients who consent for the study had the serialized envelop attached to their file. The research assistant(s) opened the envelope and knew the group allocation and attached the sticker on the patient data collection tool.

Blinding to the interventions was technically not possible for the study.

Study Process

At the commencement of the study, all consultant anaesthetists, anaesthesia residents, anaesthetic assistants and nurses that would be in contact with study participants were familiarized with the study and the data collection tool.

A standard anaesthesia protocol was followed:

Once the patient was on the theatre table, ASA recommended (33) monitoring set up (i.e. capnography, pulse oximetry, temperature, electrocardiography and non-invasive blood pressure monitoring on Mindray Wato Ex-65 monitor) applied and baseline vital signs measurement taken. Intravenous access was obtained using a gauge 18 - 20 cannula. The patient(s) was then pre-oxygenation at 6 litres oxygen flow rate for 3 minutes.

Induction was standardized as follows; Propofol 2 milligrams per kilogram IV (this was titrated to effect as is standard practice at Aga Khan University Hospital Nairobi, to avoid inadvertent adverse effects such as hypotension and bradycardia given variable patient response) and Isoflurane initiated at 2% on the vaporizer; appropriate size LMA was inserted using the classical technique(11,34);placement confirmation by auscultation and capnography and the LMA secured. Patients were manually ventilated until spontaneous breathing resumed (no mechanical ventilation was carried out as it was thought that this may confound outcome because resumption of spontaneous breathing at the end of surgery may have be delayed).

Opioid use portended to be a confounder on airway complications, as such, standardization was to be attained by administering the opioid at beginning of surgery and at recommended dosage i.e. Pethidine 1 milligrams per kilogram or Morphine 0.1mg/kg of Fentanyl 1 to 2 mcg/kg. These doses were guided by the potential pain associated with the procedure range in which the LMA is used at the Aga Khan University Hospital Nairobi. Routine use of traditional non-steroidal anti-inflammatory drugs as well as paracetamol was applied if there were no contraindications. Opioids dosage was adjusted as per patient requirements and deviation from the protocol noted.

The “end of surgery” was represented by the point marked by end tidal of 1 MAC (1.15 for Isoflurane) as the anaesthetist dialled down Isoflurane anticipating end of procedure.

NB: the study did not intend to reduce the variation at that point of the study but to investigate the impact of this intervention on theatre exit in spite of those variations. Also end tidal measurement offered an objective end point with less variation vis a vis other end points not determined by the surgeon, especially for procedures without definite end points such as hysteroscopies. 1 MAC represented a point that all patients under general anaesthesia would encounter (irrespective of alterations made to the FiISO during the procedure) after switching off the vapourizer at the end of surgery. Egress of the volatile agent thereafter being driven by the patient’s respiratory drive.

At that point (end tidal of 1.15% Isoflurane) a timer was started. The timer would be stopped once the patient existed the theatre door.

For the Deep arm of the study; Isoflurane vaporizer was turned off; Oxygen dialled to 100% at 6 litres per minute and on attaining an end tidal concentration of 1.15% Isoflurane, the LMA was removed (without deflating cuff) and an appropriate sized oropharyngeal airway placed and the patient positioned in “sniffing position”; a Hudson mask was then be placed at 6 litres oxygen flows. At the discretion of the anaesthetist the patient exited the operating theatre in transit to the PACU.

For the awake arm of the study; Isoflurane would be turned off; oxygen dialled to 100% at 6 litres flow rate; on

attaining an end tidal concentration <0.5% Isoflurane and an appropriate response to command (as defined) the LMA was removed, however, if the patient was noted to be waking up prior to attaining an end tidal of < 0.5% and had an appropriate response to command then the LMA was withdrawn irrespective of end tidal concentration of Isoflurane (This approach took into consideration that MAC awake only holds true for 50% of patients as per the definition), a Hudson mask would then be placed and oxygen administered at flows 6 litres flow rate. At the discretion of the anaesthetist the patient exited the operating theatre in transit to the PACU.

NB: Theatre exit at the discretion of the anaesthetist may have varied depending of various anaesthetic factors. We did not seek to reduce this variability as theatre turn around time was a secondary objective and we only sought to see the impact of our primary objective on turn around time despite the variability (hopefully setting the stage for subsequent study where all variables could be controlled).

Outcome

Recruitment

Data collection was carried out between February 2017 and May 2017. A total of 135 subjects were recruited, 19 were excluded and 116 proceeded into the later part of the study, 58 subjects randomized in each arm. No drop outs during collection or analysis were encountered.

Baseline Characteristics of Randomized Participants

There was no remarkable difference between the participants in the two arms of the study

Table 1: Baseline characteristics of patients between awake and deep arm

	Arm		
	Awake (n=58)	**Deep (n=58)**	**p-value**
Age			
18 – 27	8	13	0.405
28 – 37	18	23	
38 – 47	16	12	
48 – 57	14	8	
58 – 67	2	2	
Sex			
Male	19	15	0.415
Female	39	43	
Specialty			
Gynaecology	2	11	0.051
General Surgery	46	36	
Orthopaedics	9	9	
Urology	1	2	
Duration of surgery (mins)			
<=30	9	11	
31 – 60	36	24	
61 - 90	11	15	
91 - 120	2	6	0.74 ◊
121 - 150	0	0	
151 - 180	0	1	
181 - 210	0	1	
Mean duration	51.29 (19.432)	60.31 (33.307)	0.61 ◊
Opioid use			
Fentanyl	31	27	0.94 ◊
Tramadol	2	1	
Morphine	14	10	
Pethidine	24	29	
Remifentanyl	0	1	

Notes:
Pearson Chi Square test was applied
◊ Yates' correction p-value
Mann Whitney U-test was applied
P values of less than 0.05 was considered statistically significant.

Primary Outcome

There were 5 out of 58 patients in the awake arm who developed airway complications (as per definition) and 13 out of 58 patients in the deep arm who developed airway complications (as per definition)

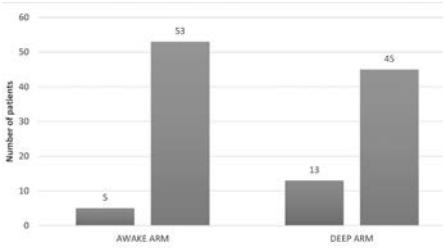

Figure 3: Comparison of occurrence of airway complication between awake arm and deep arm

Secondary Outcomes

Impact of deep versus awake LMA removal on anaesthesia theatre turn-around time (process optimization).

The mean theatre exit time (as measured from the time 1 MAC of isoflurane was noted at the end of surgery) for the Awake arm of the study was 12.29 minutes (3 3.637) and for the Deep arm of the study was 7.72 minutes (3 5.730)(Figure 4).

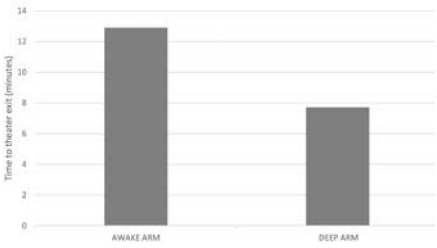

Figure 4: Comparison of mean duration of theatre exit time between awake arm and deep arm

Discussion

The primary aim of this dissertation was to investigate whether there was a difference in proportion in the occurrence of airway complications between spontaneously breathing adults patients when the laryngeal mask airway is removed deep versus awake following general anaesthesia while using Isoflurane as the sole volatile anaesthetic agent.

The secondary aims were; to compare the impact of deep versus awake LMA removal on anaesthesia theatre turn-around time.

The key finding of this study was that there was a statistically significant difference in the occurrence of airway complication (defined as - One or more of the following; airway obstruction requiring airway manipulation; laryngospasm; desaturation to 90% or less on pulse oximetry) between the awake (defined as 'MAC awake' - Alveolar concentration at which 50% concentration} for the commonly used volatile agents) arm and deep (at-least 1 MAC -Minimum alveolar concentration of Isoflurane) arm. With airway complication occurring in 5 (8.6%) of the awake arm subjects compared to 13 (22.4%) in the deep arm out of a total of 116 patients (58 in each arm) P=0.040, odds ratio 3.0622; 95% CI, 1.0139 to 9.2483.

This study found that there was a statistically significant difference ($p < 0.0001$) in the mean theatre exit time between the awake arm, 12.29 minutes (3 3.637) and the deep arm, 7.72 minutes (3 5.730).

Of note is that the study was not specifically powered to ascertain differences in the secondary outcomes (i.e. airway obstruction requiring airway manipulation; laryngospasm; desaturation to 90% or less on pulse oximetry, theatre turn around time), as such, no further analysis or conclusion was drawn from the secondary outcomes.

It is important to note that of the two patients that experienced laryngospasm and desaturation to less than 90%, none required more advance airway management e.g. endotracheal intubation or reinsertion of the LMA. Positive pressure ventilation and jaw thrust sufficed to reverse the events. The lowest saturation point of these two patients was unfortunately not noted but none of the affected patients suffered overt adverse outcome. It is also note-worthy that all airway complications occurred in theatre and none were noted in the PACU, as such, all airway interventions were promptly carried out by the anaesthetist in theatre.

Opioid use was thought to be a potential significant confounder to airway complications by causing respiratory depression and sedation, we therefore assessed its impact on outcome in these groups of patients. Given that some patients required more opioids than others because of the varied pain intensity elicited by different procedures and inter-individual variation in sensitivity to opioids and pain perception, opioids were titrated to effect and patients who required more or less opioids than the recommended doses were noted (26 of the 116 patients received an additional opioid). Of the 26 patients who received additional opioid dose(s), 4 experienced airway complications (as per definition). A Chi square test was carried out to measure association between receiving multiple opioid doses (beyond recommend dose of one opioid or a different opioid) versus a single dose of opioid, and found no statistical significance $p = 0.98$, alpha =0.05, odds ratio 0.987, 95% CI 0.2948 to 3.3043. There was also no significant difference in the opioid usage between both groups (awake vs deep arms) Yates' $p = 0.94$, alpha =0.05. There was also no significant difference in the usage of long acting opioids (i.e. Morphine) between the two groups (patients with airway complications in the deep arm vs awake arm) Chi square test $p = 0.36$, alpha =0.05.

Duration of surgery was also analysed to evaluate its impact on airway complications. This was found not to be statistically significant, with $Z = 1.48$, $p = 0.14$, alpha =0.05 (Mann Whitney U test). Also none of the patients whose surgery went beyond two hours experienced any airway complications.

The primary outcome results of this study thus reject the null hypothesis that there is no difference in the proportions of airway complications in spontaneously breathing adult patients when the laryngeal mask airway is removed deep or awake following isoflurane general anaesthesia. There was a significant difference in complications, with the deep arm show more adverse outcome.

The main finding of the study contrasts with the conclusion in the systematic review by Mathews et al. (12) that there is no superiority in either approach. The awake approached showed significantly less adverse outcomes statistically. Clinically, this study set out to have a 25% difference between the two arms be considered as clinically significant. The difference between the two arms was 13.8%, which did not surpass our set threshold. Despite this, the airway complications studied are critical events that portend adverse sequelea if unchecked. As such, it would be imprudent to disregard this finding as clinically insignificant, also considering that the calculated odds ratio was 3.0622; 95% CI, 1.0139 to 9.2483. The absolute number of airway complications, especially laryngospasm (2/116) may indeed seem small, but in our opinion the benefits of deep LMA removal are outweighed by this avoidable risk.

The incremental knowledge about the laryngeal mask airway garnered from this form of study (and others on the same subject) is the hallmark of the scientific method (i.e. acquiring new knowledge, correcting and integrating prior knowledge).This is the driving principle behind achieving best practice and patient safety in anaesthesia, which was the broad goal that underpinned this study.

Limitations

This study was relatively small and this may affect the generalizability of the results obtained from this study.

The method of randomisation chosen was progressively less random as the number of envelopes reduced, this affected the quality of the recruitment.

Conclusion

On the basis of the results of this study, it can be concluded that there is a difference in the proportions of airway complications in spontaneously breathing adult patients when the laryngeal mask airway is removed deep or awake following Isoflurane general anaesthesia. Therefore, the removal of the laryngeal mask airway while the patient is deep (anaesthetized) is not as safe as or safer than awake removal of the LMA as recommended by the manufacturer of the AuraOnce™ LMA (Ambu®) and also recommended by Archie Brain in the Intavent laryngeal mask airway manual. Therefore, in cases where it is desirable to remove the laryngeal mask airway while the patient is deep, extra vigilance is required in view of the increased potential for adverse airway complications.

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Case Presentation

Spinal Extradural Hematoma Following Spinal Anaesthesia For Emergency Cesarean Delivery

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Summary

Spinal extradural or intradural hematoma is a rare complication of diagnostic lumbar puncture, systemic illnesses or spinal anesthesia[2]. This complication could be overlooked with devastating neurological consequences due to a delay in diagnosis and management[4]. Here, we report a case of a patient who developed a lumbar spinal epidural hematoma as a result of a spinal anesthetic administered for emergency cesarean delivery due to PROM (Premature Rupture of Membranes) and failed induction of labor. The procedure was done at 1:00 am and by the following morning the patient was able to walk to the bathroom unassisted. At 9:00pm on the same day, the patient began experiencing numbness and pain on both thighs. She was subsequently diagnosed by MRI (Magnetic Resonance Imaging), with spinal epidural hematoma with cord compression at L3L4 which was surgically evacuated and she made full recovery 10 months later, with home physiotherapy.

Case Report

MNK was a 37 year old lady; Para 1[+1] Gravida 3 with a history of high blood pressure on tabs - methyl dopa (Aldomet) 500mg three times daily. She was also on Erythromycin for prophylaxis against chorioamnionitis on admission. Pre-operatively, she gave a history of laparoscopic cholecystectomy for cholelithiasis over a year earlier. Physical examination was unremarkable and she consented to spinal anaesthesia in preference to general anaesthesia. Her pre-operative blood pressure was 147/94 mmHg and she was classified as ASA IIE.

Spinal anaesthesia was performed as per the hospital protocol for spinal anaesthesia. Lumbar puncture was performed with G25 Pencan (B.Braun) needle on first attempt. Clear free-flow CSF (cerebrospinal fluid) was seen and 7.5mg heavy Bupivacaine 0.5% (Astra-Zeneca) plus Fentanyl 25Qg administered intrathecally with good desired clinical effect.

Other medications given intra-operatively included; i.v. Co-amoxiclav 1.2g, i.v. infusion of oxytocin 30 i.u., per rectal misoprostol 600Qg, i.v. Ondansetron 4mg, and i.m. morphine 10mg. The procedure progressed and ended uneventfully with an estimated blood loss of 400mls.

The following morning, the patient had complete neurologic recovery from the spinal anaesthesia and walked to the bathroom unassisted. At 9:00 pm of the same day, she complained of numbness and pain on both thighs and the primary anesthesiologist went to review her at 11:00 pm. By this time she was now complaining of numbness and weakness of both lower limbs. She was advised on the need for an urgent MRI scan to rule out any space occupying lesion but was reluctant due to cost considerations, and a consensus was reached to wait till morning then reassess the progression of symptoms if any. A full blood count was ordered and a senior colleague invited in the morning to give an opinion. Whereas the symptoms had worsened to a dense motor blockade of the lower limbs, she was still reluctant to have an MRI scan of the lumbar spine. When the scan was eventually done in the afternoon, it showed a spinal extradural hematoma at L3-L4 interspace with spinal cord compression (figure 1). A neurosurgeon was then invited to review her with the scans, and advised urgent spinal decompression through laminectomy which was done the same evening although the patient was initially reluctant to have another surgery. During surgery, hematomas were noted and evacuated both from the extradural and intradural spaces.

The INR, which was ordered pre-operatively, was reported as 1.8. She then revealed a history of chronic liver disease since the age of 16 years. It is noteworthy that the initial INR was reported as 1.1.

On the first post-operative day (after laminectomy and decompression), she remained stable but had persistent numbness of legs and thighs. LFTs (Liver Function Tests) were markedly deranged. Her gastro-enterologist was informed and incorporated in the management team.

Active physiotherapy was commenced on the 2nd post-operative day with slow but gradual improvement. She was finally discharged on the 5th post-operative day despite a persistent foot drop, to continue physiotherapy at home. Six months later, there was marked improvement and after another 4 months she had made full recovery.

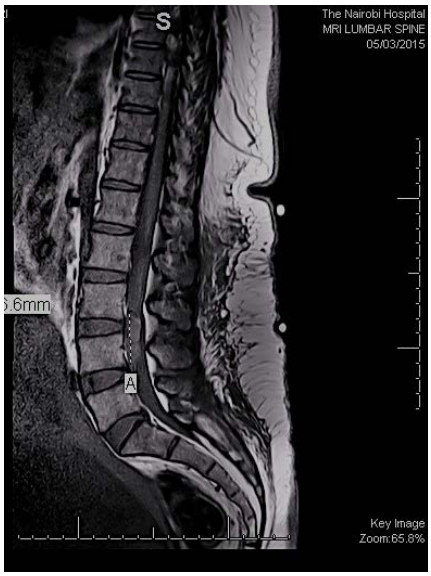

Figure 1: MRI lumbo-sacral spine with extradural hematoma- marked A.

Discussion

Spinal epidural hematoma is a collection of blood in the potential space between the dura and the bone, along the spinal canal. Significant bleeding can lead to spinal cord damage, causing neurological injury and deficit. This is a neurosurgical emergency. Non-traumatic spinal intradural (subdural and subarachnoid) hematoma (SIH) has been reported following lumbar spinal punctures, myelography and spinal anesthesia [9]. It has also been reported following spinal surgery, insertion of epidural catheters, anticoagulant therapy, trauma, and from spontaneous causes including thrombolysis, blood dyscrasias, coagulopathies, thrombocytopenia, neoplasms, or vascular malformations [2, 3, 8]. It has also been reported to occur in technically difficult spinal anaesthesia with multiple attempts at lumbar puncture [4]. Other suggested predisposing factors include spinal stenosis, or other degenerative changes in the spine, leading to obstructed cerebrospinal fluid circulation and subsequent difficulty to wash out any active bleeding. Since spinal intradural hematoma has been reported in young patients without coagulopathy and with uneventful anaesthesia, these conditions may not necessarily fit in the cause-effect profile. Although, one of the main associated factors of this complication is coagulopathy [1], some reports suggest that systemic lupus erythematosus could also be associated with hematomas at different sites on the neuraxis [7]. The source of bleeding usually comes from the iatrogenic puncture of radicular vessels in the subarachnoid space [4].

Clinical manifestations are usually delayed 2–4 days after the trigger event [4]. This patient developed the full clinical picture 2 days after the procedure. A spinal MRI is the diagnostic test of choice, and epidural hematoma is the main differential diagnosis of spinal intradural hematoma.

In patients with severe neurological symptoms such as paresis or sphincter dysfunction, urgent surgical decompression should be carried out. In a study by Lawton MT et al [4], patients taken to surgery within 12 hours of diagnosis had better neurological outcomes than those with identical neurological symptoms whose surgery was delayed beyond 12 hours. However, there are some patients who have no significant clot burden and have mild neurological symptoms or pain. Such patients could be successfully treated with conservative management [5], [6]. Indeed, Koyama T et al reported a case of spinal subarachnoid hematoma with Cauda Equina syndrome following spinal anesthesia in a patient with HELLP syndrome. The patient was managed conservatively and had almost full neurologic recovery after three months [1].

Laminectomy followed by opening of the dura and evacuation of the clots is usually the surgical strategy performed. The Cauda Equina should be carefully protected and generous irrigation should be done to wash out any little clot embedded in the nerve roots. In this patient, the surgical findings were consistent with both subarachnoid and extradural hematomas associated with Cauda Equina syndrome. The surgical evacuation was uneventful.

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The Transversus Abdominis Plane (TAP) Block – The Pawn Of The Trunk Blocks

Dr Jimmie G. Kabugi MBChB, MMed (Anesth), CTVA Fellowship, FCA(ECSA). Consultant Anesthesiologist.

Abstract

The TAP block is an easy-to-learn highly effective fascial plane block that is commonly used to provide analgesia following abdominal surgery. It may be performed using ultrasound guidance (very highly recommended) or using a blind blunted needle technique. Both methods will be discussed here for completeness.

The aim of this paper is to present the TAP block in terms of its advantages, simple ways of performing it, precautions to be taken and its overall effectiveness. The anatomical basis of the block and the required equipment will also be described.

Introduction

The Transversus Abdominis Plane block is not a new block in this country. It was introduced roughly 5 years ago and became popular due to its opioid sparing properties and also its duration of action beyond the expected duration of the local anesthetic employed. Since most of the pain from abdominal surgery is somatic, a TAP block goes a long way in reducing the patient's analgesic requirements post operatively. A TAP block performed preoperatively also constitutes pre-emptive analgesia and dramatically reduces anesthetic requirements intraoperatively.

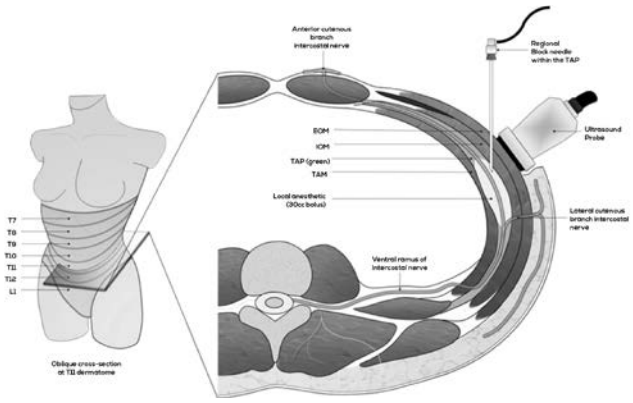
We have done hundreds of TAP blocks for many types of abdominal surgery including but not limited to cesarean sections, abdominal hysterectomies, open and laparoscopic myomectomies, open prostatectomies, umbilicoplasties, herniotomies and herniorrhaphies, excision of anterior abdominal wall masses and many other procedures.

Anecdotally, patients receiving a TAP block who also get a morphine patient-controlled analgesia device tend to use far less morphine compared to those who do not receive a TAP block. Some of the greatest benefits I have seen were in patients who tended to be sensitive to opioids such as those with sleep disordered breathing especially severe obstructive sleep apnea or central sleep apnea. Chest physiotherapy also is easier in patients who have had a TAP block for their abdominal surgery.

Anatomy

The Transversus Abdominis Plane is an easily approached potential space that lies between Transversus Abdominis and Internal Oblique muscles. The intercostal nerves that innervate the anterior abdominal wall are located in this plane. Several approaches to the TAP block have been described.

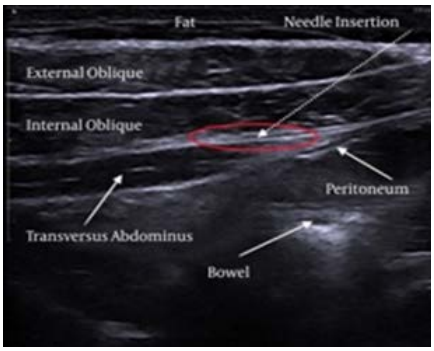
- Upper TAP – T6-T9 (Supraumbilical incisions)
- Lateral TAP – T10-T12 (Infraumbilical incisions)
- II/IH TAP – T12-L1 (Ilioinguinal/Iliohypogastric TAP for lower abdo incisions)
- Posterior TAP – Via Triangle of Petit (lower abdo incisions)



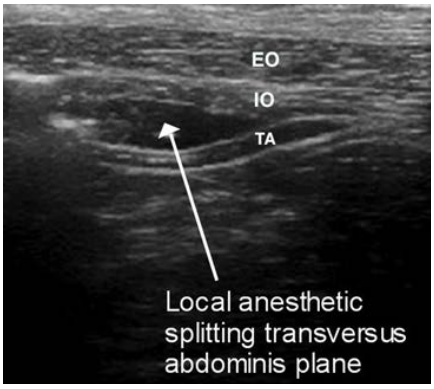
Ultrasonography

The Nuts and Bolts – How To – Ultrasound and Blunted Needle Technique

A high frequency linear probe is used to identify the three muscle layers of the anterolateral abdominal wall for the approaches alluded to above.



With the patient under anesthesia, the TAP is identified and 15 mL or more of the preferred drug mixture deposited in the TAP using a 100 mm nerve block needle following the prerequisite aspiration precautions. The solution should be seen to open up the space in a 'fish mouth' fashion. Care should be taken to ensure that the maximum safe local anesthetic doses are not exceeded.



Special blunt nerve block needles are available. One can also blunt the usual gauge 21 (Green) needle in a sterile fashion and use it to feel two pops that are easily seen and felt by the keen practitioner. The needle puncture site is usually midway between the subcostal margin and the iliac crest in the anterior or mid axillary line taking precautions not to tamper with the wound dressing if the block is done post operatively.

Drugs – Local Anesthetics and Adjuvants

The most common local anesthetic used locally is Bupivacaine due to its relatively long duration of action. Ropivacaine and Levobupivacaine are used more in the west and may be safer. The most well studied adjuvants used to prolong and intensify the TAP block include Adrenaline, Dexamethasone, Dexmedetomidine and Clonidine in various combinations and dosages. These can be looked up elsewhere but will be discussed in an upcoming paper in the Regional Anesthesia Corner. Drawbacks of the block include a lack of effect on visceral pain and a lower upper extent of blockade.

Conclusion

The TAP block should be in the armamentarium of all anesthesiologists considering the excellent analgesic profile it confers on anterior abdominal surgery and its ease of performance. Opioid sparing properties and the ease of post-operative ambulation and physiotherapy are highly desirable and will improve on the overall safety (reduced morbidity and potentially mortality) of the post-operative experience. The benefits accrued from preforming this simple block will encourage the novice regional anesthesiologist to venture into more advanced blocks leading to a much-improved perioperative experience for our patients.

Further Reading

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In Tribute

THE LATE DR. SAMUEL KIMANJARA KAHUHO, 14th AUGUST, 2018

Retired as a Senior Lecturer in Anaesthesiology and Critical Care, Dr. Samuel Kimanjara Kahuho represents just one of those heroes we celebrate in their outstanding career.

After serving as Senior House Officer at the Liverpool roup of hospitals in the 1970's, he retuned home as Fellow of The Faculty of Anaesthesia of The Royal College of Surgeons (FFARCS) then the epitome of global specialist qualification and practiced as consultant anaesthesiologist.

He served as a key member to the hitherto unknown kidney transplant anaesthesia team at the Premier Hospital as well as in various capacities in the Training and Refresher courses organized by the WFSA in the East African region between 1980 and 1988. He also served as curriculum developer and external examiner in the region as well at both Nurse Anaesthetist Level and Postgraduate Physician Examinations. Dr. S.K. as we fondly referred to him was the main drive to the education of over 40 specialist anaesthesiologists at the University of Nairobi especially
Those who had the privilege of interaction with him even briefly were amazed at the wealth of knowledge and command of facts any challenging issue that the wise old man carried with him. He was and still is admired by all who worked with him not only for (Coins, airplanes, patient transfers).

Despite his exit from mainstream anaesthesia and medical scene, Dr. Kahuho's commitment
We cannot deny these sacrifices were at a cost to his social being, and to this we are grateful to the family for accommodating our otherwise unselfish harvest of his immense knowledge and expertise which we today share in service to humanity worldwide.

Many a massage of faith, hope and gratitude have been sent through us from those he professionally mentored who currently are in many significant diverse positions of academic and clinical leadership. Dr. Kahuho received honor and recognition for this immense scholarly contribution at the All Africa Anaesthesia Congress in 2009 with special citation and award from the Global Anaesthetic fraternity.

Because the goodwill of those we serve is the foundation of our success, today we can only be grateful for his service to the anaesthetic, medical and academic fraternity.

To the family of Dr. Each act of kindness is a tiny piece of heaven we deserved to share Perpetual peace may you find in eternal rest dear Teacher Mentor and Doctor.

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27th Jan, 2018 Nairobi	*Neuro-Anaesthesia Symposium*	*Several*	*GSK*
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17th Mar, 2018 Nairobi	*Anaesthesia Technician Symposia*	*Several*	*Abbvie*
25th-27th Mar 2018 Nairobi	*Cleft Lip and Palate Conference*	*Several*	*Several*
25th-27th Mar 2018 Mombasa	*Regional Anaesthesia Workshop*	*Dr. Antony Kamau Dr. Caxton Ng'ang'a*	*B Braun*
29th Mar, 2018 Nairobi	*ARDS: Recognition and Management*	*Dr. David Odaba*	*Novartis (Nzuki)*
5th Apr, 2018 Nairobi	*Carbetocin in the Management of Post-Partum Hemorrhage*	*Dr. Patrick Olang'*	*Ferring Pharmaceuticals*
12th-13th Apr 2018 Nakuru	*Regional Anaesthesia Workshop*	*Dr. Lee Ngugi Dr. Jimmie Kabugi*	*B Braun*
19th Apr, 2018 Nairobi	*Anaesthesia and Chronic Respiratory Disease: The Role of Pulmonologist*	*Dr. Rashid Juma Bwika*	*Abbvie*
26th Apr, 2018 Nairobi	*Final Spinal Anaesthesia: Is it Drug Failure? Mechanisms and Management*	*Dr. Lee Ngugi*	*Menarini International*
10th May, 2018 Nairobi	*New Frontiers in Treatment of MDR gram Negative Infections*	*Prof. Reenah*	*Bharat Serums*
12th May, 2018 Kisumu	*Perioperative Medicine Symposia*	*Multiple*	*Novartis*
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