ORIGINAL ARTICLE

Anaesthetic Agent Usage and Wastage during Caesarean Deliveries Done with Spinal Anaesthesia in a Labour Ward Theatre: A Concern for the Financial Implication

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Abstract

Background: Local anaesthesia usage and wastage are common in the operation rooms. The wastage is often not given due considerations. Budgetary allocation for drugs is an identifiable area for cost-cutting and savings. Hence, the need to minimize wastage

Objectives: To assess and estimate the amount of local anaesthesia usage and wastage in the labour ward theatre. Also, to analyze the financial implications of the wastages and suggest appropriate steps to reduce the wastages.

Methodology: A prospective observational study conducted in the labour ward theatre of a tertiary care hospital. The amount of local anaesthesia administered to the patient during spinal anaesthesia prior to caesarean section was considered the dose used. The wastage was considered as the amount of local anaesthetic agents left unutilized in the syringes, ampules or vials after completion of each caesarean delivery. An estimation of the cost of wasted local anaesthetic agents was made.

Result: The local anaesthetic agents being used in significant quantities were hyperbaric bupivacaine, plain lidocaine and lidocaine with adrenaline. The wastage was found more during the use of hyperbaric bupivacaine as the cost of its wastage formed the bulk (N75,000.00/ $210.10) of the estimated total cost of wasted local anaesthetic agents during the study period which was N88, 100.00 ($246.77).

Conclusion: There were appropriate uses of the local anaesthesia with respect to the choice and doses for caesarean deliveries but there were wastages often ignored as infinitesimal. In the long run, the wastages become significant and the financial implication scale up the burden of health bills. Effective waste reduction strategies have input in the overall reduction of financial burden associated with health care. Emphasis should be t ailored towards awareness of these wastages among resident doctors and their prudent use of local anaesthesia.

Key words: *Cost, Lignocaine, Waste, Theatre.*

INTRODUCTION

The field of anesthesia has witnessed revolutionary advancement in drugs, equipment, and techniques in recent times. There is an attendant rise in the cost of anaesthesia services. In this period of escalating health-care expenditure, cost reduction strategies are highly relevant, especially in a developing country like ours with poor economic out-look.

The cost of pharmaceutical consumables and equipment contribute to the bulk of anaesthetic expenses. Pharmaceutical consumables like drugs are packaged in specific amounts in ampoules or vials. These drugs can only be withdrawn when the ampoules or vials are broken or the rubber stopper is penetrated with the hypodermic needle. Thus, they need to be used within a specific period without which there is risk of infection as shown in administration of over-stored opened propofol.[1] Therefore, concern for infection prevention often lead to the discarding of these partially used ampules and syringes with drugs. These wastages invariably contribute to the increasing cost of anaesthesia.[2] Besides, wasted drugs cause environmental contamination with possible harmful ecologic effects.[3]

A strategic reduction in the wastage of these drugs without compromising the quality of patient care, reduces the financial burden. This becomes necessary in a labour theatre with high utility indices.

In the late 1990s, there were average 602 deliveries yearly at our labour ward and 18.5% had caesarean births.[4] Recently, the number gradually increased to average 800 deliveries yearly with 26.9% being through caesarean deliveries.[4] This is approximately 67 births per month with 18 caesarean births. We therefore, present a prospective observational study on local anesthetic drug usage, wastage and its financial implications from a labour ward theatre of a tertiary care hospital as there seems to be apparent little concern on the wastage involving the local anaesthetic agents.

METHODOLOGY

This prospective observational study was conducted in the labour ward with two operating rooms of a tertiary care hospital. The study was carried out within a period of six months (January 2017 to June 2017) on cases of caesarean deliveries under spinal anaesthesia.

The drug preparation and the doses administered were as decided by the anesthetist handling each case, who was unaware of the study. The data for local anaesthesia usage and wastage were collected after the surgery was over, by a trained assistant (anesthesia resident doctor) who was not involved in the case management. The amount of local anaesthetic agents issued for each surgery by the nursing staff was noted and the amount left unutilized after the surgery was noted from the remaining ampoules, vials and in the syringes.

The amount of local anaesthetic agents actually administered to the patient was noted at the end of surgery from the anesthesia chart. Local anaesthetic agent wastage was considered as the amount of drug left unutilized in the syringes, opened ampules and vial after the completion of the surgery. The local anaesthetic agents that were leftover in the syringe and opened ampoules after use were discarded after the surgery as waste, after recording the amount of drug used. The vials

with rubber stoppers were handed back to the nursing staff.

The total wasted amount of each local anaesthetic agent was summed for each month. A cost estimation of the amount of the local anaesthetic agent wasted was done. The amount of drug wasted was multiplied by the maximum retail price of the drug per unit available in market at the time of study.

RESULTS

During the study period, there were one hundred and seventeen caesarean deliveries done using spinal anaesthesia. The observation revealed that 2 ampoules of 0.5 %, 4ml hyperbaric bupivacaine each, 1 ampule of 20 ml, 2 % plain lidocaine or lidocaine with adrenaline amongst other drugs were supplied for each caesarean section. The hyperbaric bupivacaine was for intrathecal administration. In some cases, it was observed that the anaesthetist used plain lidocaine for subcutaneous tissue infiltration while in others, lidocaine with adrenaline was used.

Some wasted hyperbaric bupivacaine were found in cracked ampules, while others were left in the syringes. The wasted plain lidocaine and lidocaine with adrenaline were all found loaded in syringes.

This study revealed that the wasted hyperbaric bupivacaine was more than 40 % of the volume supplied each month as can be seen in table 1 below. The wastage of plain lidocaine varied from 47% to 55% of the volume loaded in the syringe while that of lidocaine with adrenaline varied from 42% to 52%.

The cost analysis revealed that the total cost of the hyperbaric bupivacaine supplied during the study period was N163, 800.00 ($458.82) at a unit price of N1,400. 00 ($3.92) per ampule. Of this, only hyperbaric bupivacaine amounting to N88, 200.00 ($247.06) were used while hyperbaric bupivacaine amounting to N75, 600.00 ($211.76) were wasted as shown in table 2. Further analysis of the cost of wastage on plain lidocaine showed that the cost of the dose administered is approximately equal to the cost of the amount wasted (N6,800. 00/$19.05 for the dose administered versus N6,550.00/$18.35 for the one wasted).

Table 1. Number of caesarean deliveries, local anaesthesia usage and wastage per month

Months	**CS**	**H.B** used in ml	**H.B** discarded in ml (%)	**P.L** used in ml	**P.L** discarded in ml (%)	**L.A** used in ml	**L.A** discarded in ml (%)
1st	19	40	36 (47)	23	24 (51)	21	18 (46)
2nd	18	41	31 (43)	16	20 (55)	20	22 (52)
3rd	23	50	42 (45)	22	24 (52)	27	20 (42)
4th	21	44	40 (48)	23	21 (48)	21	23 (52)
5th	17	36	32 (47)	18	16 (47)	19	17 (47)
6th	19	41	35 (46)	24	26 (52)	22	19 (46)

H.B- Hyperbaric bupivacaine CS - Number of Caesarean sections P.L - Plain lidocaine
L.A - Lidocaine with adrenaline

Table 2. Estimate Cost of the drugs in Naira (US Dollar)

Months	Cost of H.B used	Cost of H.B discarded	Cost of P.L used	Cost of P.L discarded	Cost of L.A used	Cost of L.A discarded
1st	N14,000.00 ($39.22)	N12,600.00 ($35.29)	N1,150.00 ($3.22)	N1,200.00 ($3.36)	N1,050.00 ($2.94)	N900.00 ($2.52)
2nd	N14,350.00 ($40.20)	N10,850.00 ($30.39)	N1,300.00 ($3.64)	N1,000.00 ($2.80)	N1,000.00 ($2.80)	N1,100.00 ($3.08)
3rd	N17,500.00 ($49.02)	N14,700.00 ($41.18)	N1,100.00 ($3.08)	N1,200.00 ($3.36)	N1,350.00 ($3.78)	N1,000.00 ($2.80)
4th	N15,400.00 ($43.14)	N14,000.00 ($39.22)	N1,150.00 ($3.22)	N1,050.00 ($2.94)	N1,050.00 ($2.94)	N1,150.00 ($3.22)
5th	N12,600.00 ($35.29)	N11,200.00 ($31.37)	N900.00 ($2.52)	N800.00 ($2.24)	N950.00 ($2.66)	N850.00 ($2.38)
6th	N14,350.00 ($40.20)	N12,250.00 ($34.31)	N1,200.00 ($3.36)	N1,300.00 ($3.64)	N1,100.00 ($3.08)	N950.00 ($2.66)
Total	**N88,200.00 ($247.06)**	**N75,600.00 ($211.76)**	**N6,800.00 ($19.05)**	**N6,550.00 ($18.35)**	**N6,500.00 ($18.21)**	**N5,950.00 ($16.67)**

H.B- Hyperbaric bupivacaine P.L - Plain lidocaine L.A - Lidocaine with adrenaline

The unit price was N1000.00 ($2.80) per ampule of 20 ml of both plain lidocaine and lidocaine with adrenaline. The difference with regard to lidocaine with adrenaline was N550.00/$1.54. However, the total cost of all wasted local anaesthetic agents was N88, 100.00 ($246.77).

DISCUSSION

Waste is generated daily from human activities. In the hospitals, patient care results in waste generation. Theatre operations are significant sources of these waste.

Anaesthesia-related waste includes such items as syringes, drug vials, intravenous cannula, spinal/epidural needles, blood bags and drugs. These have significant environmental and health impact.[5] However, this waste is of concern to anaesthetists, because it represents a hidden source of waste of healthcare funds and increases the cost of anaesthesia care.

The use of local anaesthesia during caesarean deliveries is for optimum comfort of the patients as their pain is often ameliorated with appropriate choice and adequate dose of local anaesthesia. Hyperbaric bupivacaine is the local anaesthetic agent of choice for spinal anaesthesia because of its pharmacological profile with longer duration of action compared to lidocaine.[6]

In our study, we observed the appropriate use of hyperbaric bupivacaine for spinal anaesthesia but significant amount of its wastage was noted. This was probably because each supplied ampule of 0.5 % bupivacaine contains 4ml. Only about half of the content was administered intrathecally for each spinal anaesthesia during the surgery. The remaining hyperbaric bupivacaine in the opened ampule became a waste. In few cases of failed spinal anaesthesia with limited or patchy block, the procedure was repeated with resultant opening of second ampule leading to a left over in the opened ampule. It has been

established that pregnancy shows more sensitivity and susceptibility to the toxic effect of bupivacaine.[7] Hence, the reduced dose of intrathecal bupivacaine for caesarean section as a safety precaution. The intrathecal dose for non-pregnant adult ranges from 15-17.5 mg (3-3.5 ml of 0.5 %).[6] Chaudhary *et al.* demonstrated similar wastage of propofol left in the opened vial after the surgeries. [8]

The cost estimation revealed 46 % waste of the amount of money spent to procure hyperbaric bupivacaine during our study period. The waste analysis on each caesarean delivery was very small but the accumulation over a long period would no doubt be highly significant. A similar study by Kaniyil *et al.* revealed a large amount of fund lost in significant quantity of propofol observed as leftover after the surgery. [9]Gillerman and his colleague also documented avoidable wastage of enormous dollars on the drug use inefficiency.[10]

A method to reduce this wastage of hyperbaric bupivacaine is provision of feedback to the providers who will most likely reduce the content of each vial to about 2-2.5 ml and make it strictly for spinal anaesthesia during caesarean deliveries. Re-emphasis of reduction strategies in the post marketing surveillance of drugs should be sustained.[11]

Our study also revealed that the use of plain lidocaine and lidocaine with adrenaline was appropriate in terms of dose and intended effect for subcutaneous infiltration before spinal anaesthesia. The patients can receive up to 7 mg/kg of plain lidocaine and up to 3 mg/kg of lidocaine with adrenaline.[12] The study patients received below these doses and had adequate anaesthesia at the area of introduction of spinal needle. However, the choice of plain lidocaine or lidocaine with adrenaline by the attending anaesthetist was based on availability. It could have been better to use lidocaine with adrenaline which reduces bleeding and prolong the duration of action of lidocaine, provided there is aspiration before injection to avoid intravascular administration.[13]

Even though, effective doses of plain lidocaine and lidocaine with adrenaline were used, our study further revealed that overloading the intended doses of plain lidocaine and lidocaine with adrenaline in the 5 ml syringes for subcutaneous infiltration was responsible for their wastage. In most cases, an average of 2ml was administered to the patient. The unused leftover in the syringes were always discarded and it was observed that the amount in the syringes as leftover was almost same amount administered to the patients. The anaesthetist might have loaded more than needed in cases of spill over to avoid going back to the vial with rubber stopper to reload. This way, infection prevention protocol is strictly being adhered to. Amucheazu *et al.* in Enugu, found out that most of the intravenous anaesthetic agents loaded into the syringes were never used at all, constituting bulk of the wastage.[14]

Yimer and co-worker also found that maximum wastage was noted in drugs loaded in syringes and not used.[15] However, Dee noted that there is additional wastage in the partially used intravenous bag containing injected anaesthetic drugs. [16]

The cost of 2 % plain lidocaine and 2 % lidocaine with adrenaline is not expensive in relation to hyperbaric bupivacaine in volume to volume comparison. However, the cost of wasted plain lidocaine was 96 % of the cost of

administered dose while that of lidocaine with adrenaline was 91 %. These were significant and can be reduced by simply loading the appropriate required dose or ordering for pre-packaged drug syringes.

The reduction of drug wastage is important in view of its impact on the cost of anaesthesia care. Hawkes *et al.* suggested that efforts should be made to minimize drug wastage by raising cost awareness. [17] However, Riley did not agree with this practice and argued that anaesthetic drug costs should not be taken in isolation but that other costs should be considered while aiming for minimal wastage.[18]

Vinodkumar and colleague carried out a study on cost-minimization in anesthesia and found out that the mean cost per case decreased significantly following application of an interventional education program focused on waste reduction. [19] They also emphasized the importance of reinforcing such educational programs at regular intervals.

Development and implementation of practice guidelines for drug usage, feedback about drug wastage to provider, monitoring the practice of waste reduction protocols and yearly audits will immensely yield positive outlook. Seminars and symposiums on drug wastage and cost reduction strategies should be encouraged. It should also be co-opted into continuing medical education programs. Simple practice of placing a price list near drug tray will function as a visual reminder of importance of waste reduction and should be inculcated.

A few limitations of our study include the spilled local anaesthetic agents from the loaded syringe during administration and fallen ampules with subsequent breakage, spilling its contents. These could not be accurately estimated.

CONCLUSION

Local anaesthesia usage is common in caesarean deliveries. However, wastage does occur and inadvertently ignored as insignificant. The attendant financial loss constitutes significant portion of financial burden in the long run. This gives an insight into potential wastage of other anaesthetic drugs in the main theatre complex involving other major surgeries. Although some amount of drug wastage is inevitable in anesthesia, waste reduction strategies suggested will be helpful in decreasing the financial loss without compromising the quality of patient care.

We hope this study findings will raise awareness of financial implication of drug wastage among the resident doctors of our baby delivery team so that we will be prudent in drug handling and administration. Further studies on other drug wastages especially intravenous anaesthetic agents in the main theatre complex where major surgeries are done, are needed for full scale cost reduction strategies in all the theatres.

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