Ocular Anaesthetic Failure Following Peribulbar Administration of Lidocaine

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ABSTRACT

This article reports a failure in achieving adequate anaesthesia following local peri-ocular block. Failure can be partial where subtle pain is felt and it can be total, in which akinesia and analgesia are not achieved. We report a case of failed local(ocular) anaesthesia in a Nigerian male scheduled for intra ocular lens implantation.

Our patient is a 48-year-old man who presented to the eye clinic with complaints of poor vision of count finger in left eye following cataract surgery at an external eye facility. Examination revealed mid-peripheral cornea opacity and aphakia. Posterior segment examination was essentially normal. A +10 lens over the index eye improved visual acuity to 6/12. He was scheduled for elective scleral fixation of posterior chamber intraocular lens, which was aborted intraoperatively due to failure to achieve adequate ocular anaesthesia probably due to local drug resistance.

More research into the causes of anaesthetic failure is required and it is worth noting that anaesthetic failure should be approached using an alternative anaesthetic agent or alternative route.

Keywords: ocular anaesthetic failure, failed regional anaesthesia, scleral fixation of intraocular lens

INTRODUCTION

Ophthalmic surgical procedures are mostly done under local regional anaesthesia because of the enclosed anatomy of the orbit. Anaesthesia is a vital component of ocular surgery. Achieving anaesthesia along with akinesia and analgesia and allows the surgeon to perform calculated and precise intra ocular movements and manipulation of tissues with instruments. Patients are able to give satisfactory remarks following effective anaesthesia as well. Failure of anaesthesia can adversely affect the outcome of a procedure, cause damage to surrounding tissues and consequently cause untoward complications which can be long term or permanent. It can lead to significant morbidity for the patient and in some cases loss of the eye. The cause of anaesthetic failure range from resistance to anaesthetic agent,[1] genetic proclivities,[2] technical mistakes,[3] local infection[4] and others.

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We present a case of ocular anaesthetic failure in a patient scheduled for elective intra ocular lens implantation who demonstrated an unusual poor response to the anesthetic agent lidocaine.

CASE REPORT

The patient is a 48-year-old male who was referred to Lagos State University Teaching Hospital (LASUTH) Eye Institute for implantation of intraocular lens in his left eye.

In his history, he reported tooth extraction under local anaesthesia 5 years ago which was uneventful, cataract extraction under local anaesthesia with intraocular lens (IOL) implantation in the contralateral eye 4 years prior with no adverse event. Few months prior to presentation, he had cataract extraction without IOL implantation in the left eye which was said to have been aborted due to aggravated pain during surgery. He doesn't take alcohol, cigarette or hard drugs. He worked as a plumbing technician and changed jobs 4 years ago to become a pool maintenance technician.

He was one of nine patients who had elective intraocular procedure on this day via peribulbar administration of lidocaine administered by the senior doctors in the unit. All patients had 5mls of lidocaine with adequate akinesia and analgesia except our index patient who was given a supplementary 5mls followed by an additional 3mls in the subconjunctival space with generous instillation of topical tetracaine which led to sub-optimal akinesia and analgesia. Procedure continued however and few minutes intraoperatively at the point of Intraocular lens implantation, pain escalated with subject screaming and writhing at every contact of instrument with the eye. This necessitated that the procedure be stopped and postponed.

A month after, we obtained informed consent to proceed to skin testing to elucidate if there was a possible focal or systemic aetiology in patient's response to the anaesthetic agent. Subject confirmed not taking alcoholic or caffeinated drinks in the last 24 hours preceding test. The flexor surface of the arm was cleaned with an alcohol prep pad. 3 sets of 2 centimetre rings were drawn using a tissue marker. Agents tested were, saline, bupivacaine and lidocaine. Using a well labelled insulin syringe, 0.3ml of each agent was injected into the rings creating an elevated subcutaneous wheal.

Pain and fine touch were assessed every 5 minutes with the patient blindfolded. Pain was graded using the internationally recognized pain scale from 0 to 10; with 0 representing no pain, 10 being unbearable pain, while 5 represents a level of pain that is intermediate between 1 and 10.

In a bid to standardise pain assessment, the weight of the index finger over the end of the needle exerted an initial pain score of 3, and this weight was maintained through the rest of the test. A sterile 21-gauge beveled end needle was applied with a fairly constant pressure at the centre of each ring. Fine touch was assessed using a cotton wick applied at the centre of each ring and subject response was classified as either present(P) or absent(A). Patient was blindfolded while response for pain and fine touch for each of the 3 different agents injected was tabulated.

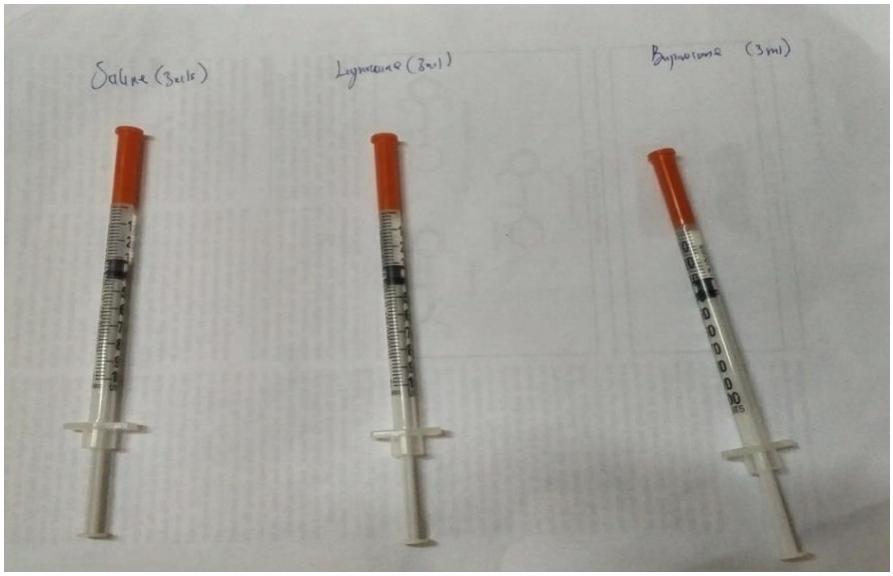

Figure 1: Image showing test agent injected subcutaneously

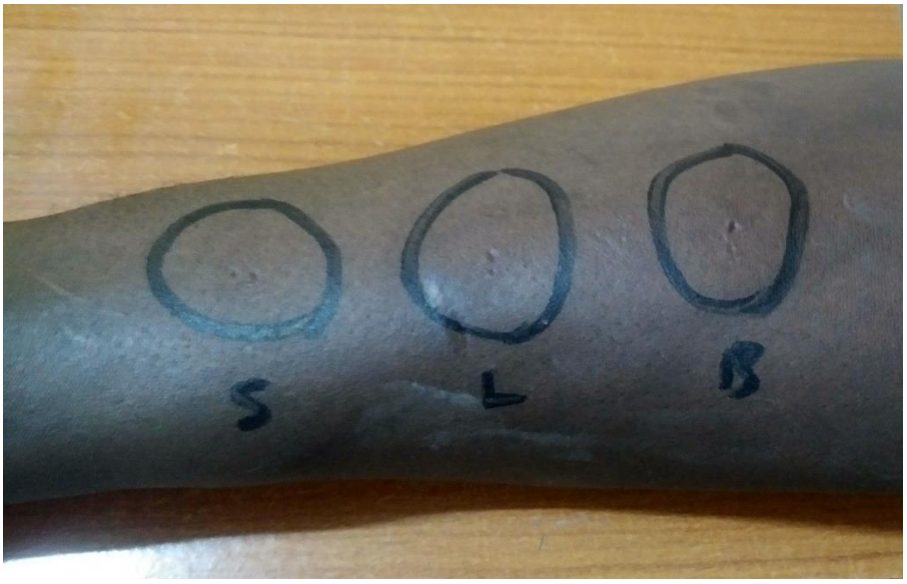

Figure 2: Image showing flexor surface of forearm labeled for administration of test agent

RESULTS

Test agent: Lidocaine

Date of Production: 07/2018

Expiry: 06/2021

Volume of active agent used: 0.3mls

Percentage concentration of active agent: 2%

Anatomical Area: Forearm flexor surface

Table 1: Table showing response to test agent Lidocaine

Time(min)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	75
Tissue reaction	RW	RW	RW	RW	RW	RW	RW	RW	FW	FW	FW	FW	FW	FW	FW
Sensation (cotton wick)	A	A	A	A	A	A	A	A	P	A	A	A	A	P	P
Pain(21G)	1	1	0	0	0	0	1	5	1	2	5	3	5	4	5

RW: raised wheal **A**: Absent **P**: Present **FW**: flat wheal

Test agent: Bupivacaine

Date of Production: 15/01/19

Expiry: 14/01/2023

Volume of active agent used: 0.3mls

Percentage concentration of active agent: 0.5%

Anatomical Area: Forearm flexor

Table 2: Table showing response to test agent Bupivacaine

Time(min)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	75
Tissue reaction	RW	RW	RW	RW	RW	RW	RW	FW	FW	FW	FW	FW	FW	FW	FW
Sensation (cotton wick)	A	A	A	A	A	A	A	A	P	A	P	A	A	A	A
Pain(21G)	1	1	0	0	0	0	0	0	0	0	0	0	2	2	2

RW: raised wheal **A**: Absent **P**: Present **FW**: flat wheal

Test agent: Saline

Volume of active agent used:0.3mls

Percentage concentration of active agent:

Anatomical Area: forearm flexor

Table 3: Table showing response to test agent Saline

Time(min)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	75
Tissue reaction	RW	RW	RW	RW	RW	RW	FW	FW	FW	FW	FW	FW	FW	FW	FW
Sensation (cotton wick)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Pain(21G)	0	1	3	1	2	2	2	2	1	0	0	1	1	9	7

RW: raised wheal **A**: Absent **P**: Present **FW**: flat wheal

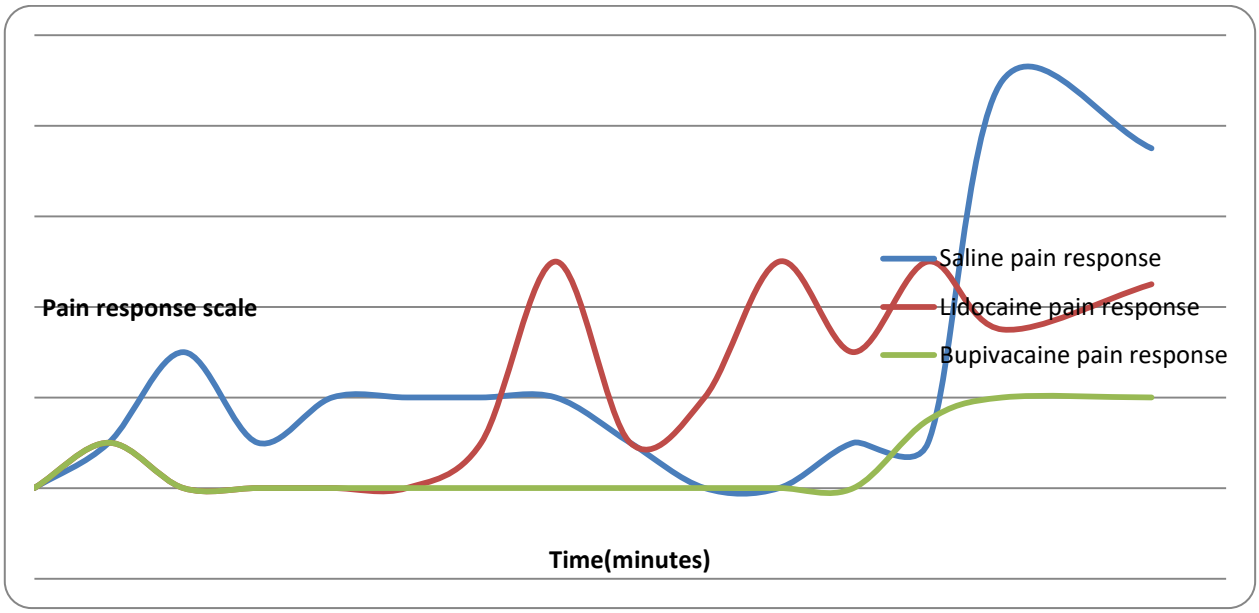

Figure 3: Graphical representation of pain response from test agents

Pain sensation with bupivacaine was consistently low for close to an hour whereas lidocaine maintained good anaesthesia for about 30 minutes before significant pain response was observed. Saline was associated with the highest pain sensation and pain was felt consistently through the test duration except for a dip at the 50 minute.

DISCUSSION

Anaesthetic failure is common.[5] In dental practice, it has been reported in up to10% of cases of inferior alveolar nerve block and 7% of all cases of local anaesthesia in general practice with possible causes being infection, patient anxiety, anatomic variations and inadequate technical know-how leading to anaesthetic failure.[5] Ocular anaesthetic failure however, has been poorly reported in the literature.

In ophthalmic surgeries, pain management can make or mar the outcome, hence it is one of the major aims of anaesthesia, the other objective being akinesia. The choice and method of anaesthesia for ocular surgeries differ. For lengthy procedures usually exceeding 30 - 45 minutes, long acting anaesthetic agents such as bupivacaine are preferable, while for short procedures, lidocaine is usually the drug of choice. Method of administration include topical, subconjunctiva, sub-tenon, peribulbar and retrobulbar. Facial blocks are sometimes useful as well.[6]

Skin testing of 2 commonly used anaesthetic agents lidocaine and bupivacaine and a saline control revealed no gross abnormality. The anaesthetic effect of Lidocaine was apparent for

about than 30 minutes after which subjective responses was significantly maintained between 3 and 5 of the pain scale. This correlates very much to the already known pharmacology of lidocaine with an onset of action of 0 to 5 minutes and duration of action of 20min to 1 hour. However, bupivacaine seems to be more effective in maintaining a low pain sensation for the 1 hour when pain and fine touch was tested.

Pain acclimatization from recurrent needle prick was evident at about 50 minutes in the saline test group when he signified no pain despite repeated testing. This was followed by a sharp spike in pain sensation.

Local anaesthetic agents are weak amine bases.[7] Electrolyte imbalance are major considerations in the response to local anaesthetic.[8] The onset of action and duration of action are altered by the local tissue they are administered. In this case, the orbit is peculiar as it contains sheathed muscles with fatty cushion. Tissues with acidic PH demonstrate the least response to the effect of local anaesthetic agent. There was sign that the tissues around the orbit in this patient were in a focal state of acidosis or alkalosis as this could have reflected systemically in the form of systemic acidosis.

Stimulants such as caffiene,[9] depressants and level of circulating catecholamines have also been found to have a negative or positive effect on subjective pain response.[10]

Medication and technical failure could give undesired anaesthesia, however these were excluded as possible causes since the agent was administered by two senior surgeons and also, medication was administered to 8 other patients who achieved adequate analgesia and akinesia without requiring any supplementary dose.

Anatomic considerations in anaesthetic failure stems from the fact that the retro-bulbar space is a relatively compact space with fat and fibrous septa which can hinder proper diffusion of anaesthetic agent hence the use of enzymatic agent hyaluronidase which dissolves the fibrous septa allowing easy anaesthetic diffusion. Hyalase was however used in this case. It is however unlikely that anaesthetic failure was due to administration of hyalase with lidocaine as the patient also had subconjuctival lidocaine injection and topical tetracaine with no improvement in pain management. The normal duration of action of lidocaine has been shown to vary from between 30min to 1 hour. The near normal response to lidocaine in our skin test did not correlate with the unusual response to lidocaine administered via peribulbar, subconjunctival and topically in this case. Hence, the hypothesis that local tissues respond differently to anesthetic agents.

Another pathophysiologic factor for resistance or complete failure of local anaesthetics maybe due to variants or mutation in the voltage-gated sodium channels and axonopathy leading to impaired nerve response to anaesthetic agents.[11]

Occupational hazard was proposed as a possible cause of anaesthetic resistance. He had a past history of surgical dental procedures including surgery to the contralateral eye which were uneventful. However, patient changed his job and started working as a pool maintenance technician for the past 4 years and is constantly exposed to cleaning chemicals containing chlorine and bicarbonate in powder and aerosol form. We hypothesized that these chemicals when exposed to the eye in non-toxic quantities can dissolve in the tear film and form soluble nerve sensitizing salts which are rapidly absorbed by the mucous membrane of the conjunctiva into the eye and its adnexa leading to increased sensitivity to pain in affected tissues and a poor response to anaesthetic agents.

LIMITATIONS

Additional administration of intracameral anaesthetic agent could have helped if available at the time of surgery. There is need to stock intracameral anaesthetic agents in cases of suspected anaesthetic failure.

CONCLUSION

We have presented a case of a Nigerian male who failed to achieve adequate anaesthesia following peribulbar administration of lidocaine supplement with subconjunctival and topical administration. Skin test to lidocaine, bupivacaine and saline as control revealed no abnormal response to these agents. More studies are required on individual idiosyncratic response to pain and factors affecting response especially in ophthalmic surgical procedures requiring local anaesthesia. We should be particularly open to this phenomenon in both elective and emergency ocular procedures and also plan a mode of response, such as considering alternative agents or alternative routes. Occupational exposures are possible aetiology in the pathogenesis of anaesthetic failure. More research is however required.

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