

A Safe, Efficacious and Cost Effective Way of Delivering SubtenonsAnaesthesia During Cataract Surgery.

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ABSTRACT

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Aims: There are considerable pressures in various health economies at present to reduce costs whilst maintaining patient safety and clinical efficacy. We report a new simplified regime for the administration of Sub-Tenon's anaesthesia offering a cost saving of up to 95% whilst maintaining total safety and efficacy.

Study design: The study compared usage of 2% Xylocaine (2% Lignocaine with 1:200000 Adrenaline) over the more prevalent regime of 2% Bupivacaine + 2% Lignocaine + Hyaluronidase in terms of cost, patient satisfaction, safety and efficacy prior to phacoemulsification surgery.

Place and Duration of Study: Sample: Department of Ophthalmology, Royal Preston Hospital, Preston UK between July and November 2010.

Methodology: Following topical anaesthesia with 3 drops of Proxymetacaine 0.5% drops instilled one minute apart and subsequent administration of a drop of 5% Povidone Iodine aqueous solution into the conjunctival sac, 2ml of 2% Lignocaine with 1:200000 adrenaline was administered as a Sub-Tenon's injection to 100 eyes of consecutive patients undergoing phacoemulsification. Pain levels during the administration of the injection and during surgery were monitored by measuring Visual Analogue Pain (VAP) scores via a prospective questionnaire immediately after the operation.

Results: There were 100 eyes of patients undergoing cataract surgery included in this study. No patient required top up anaesthesia during the surgery and no serious anaesthetic related intra or post-operative complication was noted in any of the patients. The mean VAP score during delivery of anaesthetic and for the duration of surgery were both 0.

Conclusion: Our results show that this regime for administration of Sub-Tenon's anaesthesia meets the standards required in terms of both safety and efficacy whilst delivering considerable cost savings. We recommend its routine use for the reasons cited above.

Keywords: [Sub-Tenon's anaesthesia, Cataract surgery, Local anaesthetic, Cost effectiveness]

21 1. INTRODUCTION

22

23 Local anaesthesia for cataract surgery has been shown to be a safe and efficient mode of
24 anaesthesia for routine daycase cataract surgery [1,2] and there is some evidence to
25 suggest that it is preferred by patients.[3] According to a Cochrane review meta-analysis by
26 Davison et al, it is still the anaesthesia of choice with regards to minimising overall pain
27 perception and intraoperative complications. [4]

28 A variety of local anaesthetic agents are employed in the administration of Sub-Tenon's
29 block. The hitherto prevalent regime in our department has been utilising 5ml of a
30 combination of 0.5% Bupivacaine, 2% Lignocaine and Hyalase for the subtenon's block.
31 Our simplified regime consists of using 2ml of 2% Xylocaine (2% Lignocaine with 1: 200,000
32 adrenaline).

33 Our reasons for choosing this preparation were based on our experience that it was an
34 effective and safe method of pain control during surgery and secondly the marked cost
35 advantage over the prevailing regime which amounted to a 95% cost saving per patient. This
36 is highly relevant in the context of a National Health Service that faces considerable
37 pressures to innovate in order to reduce costs whilst maintaining patient safety and clinical
38 efficacy. Cataract surgery is one area in which the high turnover of patients allows for small
39 savings made per person to translate into larger financial gains. Our aim was to assess the
40 effectiveness of our practice in terms of safety, efficacy and meeting the standards required
41 for pain free cataract surgery.

42 The Royal College of Anaesthesia and Royal College of Ophthalmologists published
43 guidelines in their 2012 paper [5]regarding the administration of local anaesthesia in cataract
44 surgery. In this, the goal of anaesthesia for intraocular surgery is:

45 -To provide pain-free surgery and to minimise the risk of systemic complications

46 -To facilitate the surgical procedure

47 -To reduce the risk of surgical complications

48 Visual analogue pain (VAP) scores have been used in a number of studies to assess pain
49 following Sub-Tenon's anaesthesia. [2,6,7,8,9] Stevens was the first to describe a series of
50 50 patients undergoing Sub-Tenon's anaesthesia and measured pain during both surgery
51 and administration of anaesthesia using a VAP scale. [6]The mean scores were found to be
52 1 for both of these measurements.

53 Our aim was to determine if our current practice of administration of Sub-Tenon's local
54 anaesthesia for day case cataract surgery meets the accepted standards required in
55 anaesthesia.

56 We evaluated the level of pain experienced by the patient during both anaesthesia and
57 surgery. Our standards are:

58 1. To achieve minimal or no pain during delivery of the Sub-Tenon's block

59 (i.e. VAP score of <2)

60 2. To achieve pain free surgery (i.e. VAP score of 0)

61 3. No systemic or serious local adverse effects of anaesthesia

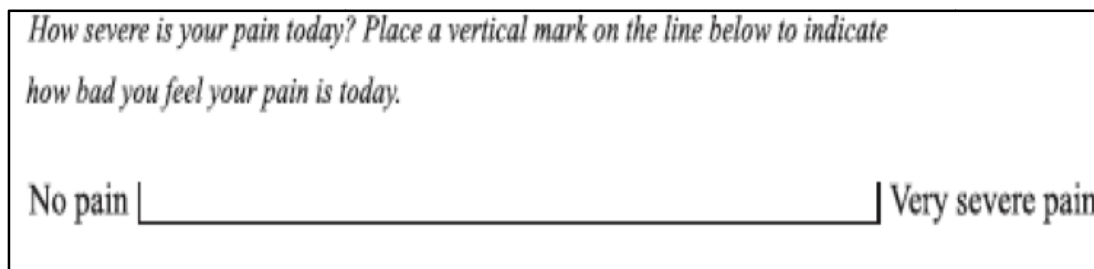
2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY

This was a prospective longitudinal questionnaire based study where 100 consecutive eyes of all patients undergoing routine cataract surgery as a day-case procedure were included. Exclusion criteria included patients with profound deafness, dementia, learning difficulties, high anxiety or an allergy to any of the compounds being used.

Patient monitoring of blood pressure, pulse oximetry and heart rate was performed throughout the procedure by a suitable trained individual as per Royal College recommendations. In all cases 2ml of Lignocaine and adrenaline 1:200000 was used for injection from a single 20ml bottle. Sterility was maintained by drawing up syringes of anaesthetic for each patient on the list and appropriately labeling them with "anaesthetic" prior to the start of the list.

The Sub-Tenon's anaesthetic was delivered by 1 of 3 surgeons (SB, KJ or KT). Three drops of proxymethacaine were instilled into the inferior fornix at 1-minute intervals. Povidone iodine was given in the conjunctival sac and over the lashes. The patient was asked to look upwards and outwards. The inferonasal bulbar conjunctiva was grabbed using a Moorfields forceps and a small incision was made using curved Wescott scissors. The Sub-Tenon's cannula was inserted along bare sclera and 2 ml of the anaesthetic solution was injected slowly into the Sub-Tenon's space.

The patient was asked to mark their pain score on the visual analogue pain scale immediately after surgery for 1) the delivery of anaesthetic and 2) the duration of surgery.



The diagram shows a horizontal line representing a pain scale. Above the line, the text reads: "How severe is your pain today? Place a vertical mark on the line below to indicate how bad you feel your pain is today." Below the line, the text "No pain" is on the left and "Very severe pain" is on the right, separated by a vertical bar. The line itself is a continuous horizontal bar.

Figure 1: Visual Analogue Pain (VAP) score scale

The patient subsequently underwent cataract surgery using the standard phacoemulsification (Bausch+Lomb MillenniumPhaco System) and insertion of intraocular lens technique.

3. RESULTS AND DISCUSSION

There were 100 patients included in the study. No patient required top up anaesthesia during the surgery and there were no complications of anaesthesia. The mean VAP score for delivery of anaesthetic and duration of surgery was 0 in both cases. 100% of patients felt no pain during surgery. 98% of patients gave a VAP score of 0 and 2% a score of 1 for delivery of Sub-Tenon's anaesthesia (mean 0.02, or effectively 0). There were no intra and postoperative complications (up to 1 months follow up) related to the surgery with average surgery time of 25 minutes.

102 Our results meet the standards we had defined earlier. Furthermore our findings compare
103 favourably with those in the literature where VAP scores have been used to determine pain
104 during cataract surgery or delivery of anaesthetic.

105 Srinivasan et al [9] report mean VAP scores of 2.42 taken immediately after cataract
106 surgery with Sub-Tenon's anaesthesia in a randomised clinical trial comparing topical and
107 Sub-Tenon's anaesthesia. Similarly Zafirakis et al [7] report a mean VAP score of
108 1.53(SD0.63) for delivery of anaesthesia and 0.57(SD1.28) during surgery.

109 Of note is the study by Rowley et al[8], in which they used a similar anaesthetic combination
110 to ours, however their group of patients were subdivided into two depending on whether or
111 not hyaluronidase was given. Hyaluronidase was found to improve akinesia however had no
112 significant effect on pain scores. Akinesia was not measured in our study as many cataract
113 surgeons will nowadays accept a small degree of ocular movement during surgery provided
114 the patient is pain free and cooperative.

115 Although it has been argued that a limitation with VAP scores is their inter-observer
116 variability, nevertheless as a guide to pain relief, an already subjective modality, they have
117 proved useful in arbitrary comparisons and effectiveness of anaesthesia.

118 There were no complications from anaesthesia in our series of patients apart from the
119 occasional localized conjunctival chemosis, which is not deemed a significant complication
120 of Sub-Tenon's anaesthesia. Some surgeons may be wary of using adrenaline in the Sub-
121 Tenon's space. The risks of using dilute adrenaline in Sub-Tenon's anaesthesia are by no
122 means established. Our experience with this study and having used the same preparation in
123 over 800 cases prior to this study has not yielded a single adverse effect of its use in the
124 doses described above. Also, we could not find any reported cases in the English literature
125 of central retinal artery occlusion secondary to the use of adrenaline in the Sub-Tenon's
126 space.

127 Experiments on rabbits whereby blood flow to ocular structures was analysed using colour
128 Doppler techniques show a reduction in blood flow to certain ocular structures (iris, ciliary
129 body) following retrobulbar injection of adrenaline.[10] In this paper however 2% adrenaline
130 was utilised, approximately 4000 fold more concentrated than our preparation. In addition,
131 we argue that unlike the retrobulbar space, the Sub-Tenon's space is not in direct contact
132 with the optic nerve sheath, which is pierced by the ophthalmic artery and vein. Although
133 some intraconal leakage of anaesthetic might occur, this is perhaps further limited by the
134 relatively smaller volume of anaesthesia administered in our series (2ml) compared with the
135 standard 3-5ml described with Sub-Tenon's techniques.

136 Krohn et al [11] report certain distinct advantages of retrobulbar anaesthesia with combined
137 adrenaline in a study involving 75 patients. Compared to patients receiving anaesthetic
138 alone, adrenaline appeared to have a mydriatic as well as an intraocular pressure lowering
139 effect. In addition by virtue of its vasoconstrictor effect it helped increase both the duration of
140 anaesthetic effect and postoperative analgesia by slowing down the absorption of the
141 anaesthetic agent.

142 Pohjanpelto et al argue that introduction of epinephrine 5mg/ml into the anaesthetic solution
143 made no difference to the intraocular blood supply over and above that caused by the retro
144 bulbar block alone.[12]

145
146

4. CONCLUSION

The results indicate that the prescribed criteria and standards were being met in terms of providing pain free surgery, with minimal pain (VAP<2) for delivery of anaesthesia. There were no complications arising as a result of this technique.

The additional cost advantage in the setting of the modern financially constrained NHS can also not be overlooked with the cost of delivery per anaesthetic cocktail per patient being £9.11 per patient for the lignocaine-bupivacaine-hyalase combination regime and only £0.17 per patient with our suggested regime.

We conclude that the use of lignocaine 2% with adrenaline 1:200000 in our current regime of delivery of Sub-Tenon's anaesthesia for cataract surgery is not only safe and effective but also highly cost efficient.

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COMPETING INTERESTS

No competing interest exists for the authors.

AUTHORS' CONTRIBUTIONS

'Author A' carried out the study, performed the literature search statistical analysis, and wrote the first draft of the manuscript. 'Author B' carried out the study, performed statistical analysis and made the final changes to the manuscript prior to submission and 'Author C' designed, supervised and carried out the study. All authors read and approved the final manuscript.'

CONSENT (WHEREEVER APPLICABLE)

All authors declare that written informed consent was obtained from patients involved in the study as part of their cataract surgery and in line with the Hospitals guidelines. Copies of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.'

ETHICAL APPROVAL (WHEREEVER APPLICABLE)

No ethical approval was necessary for this study.

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233 **DEFINITIONS, ACRONYMS, ABBREVIATIONS**

234 Nil required.

235 **APPENDIX**