

A Safe, Efficacious and Cost Effective Way of Delivering Subtenons Anaesthesia 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]*

1. INTRODUCTION

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

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

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

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

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

- To facilitate the surgical procedure

- To reduce the risk of surgical complications

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

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

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

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

- 64 (i.e. VAP score of <2)
65 2. To achieve pain free surgery (i.e. VAP score of 0)
66 3. No systemic or serious local adverse effects of anaesthesia

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68 **2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY**

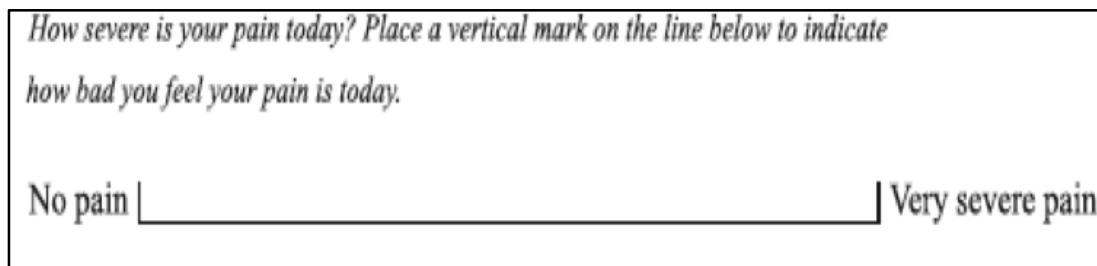
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70 This was a prospective longitudinal questionnaire based study where 100 consecutive eyes
71 of all patients undergoing routine cataract surgery as a day-case procedure were included.
72 Exclusion criteria included patients with profound deafness,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

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

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

86 The patient was asked to mark their pain score on the visual analogue pain scale
87 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 left end is labeled "No pain" and the right end is labeled "Very severe pain". A vertical line is drawn at the right end of the horizontal line, indicating the "Very severe pain" point.

88

89 **Figure 1:** Visual Analogue Pain (VAP) score scale

90

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

94

95

96 **3. RESULTS**

97

98 There were 100 patients (n=100) included in the study. The mean VAP scores for pain
99 during delivery of the anaesthetic and during the surgery was 0 respectively. 98 patients
100 (98%) gave a VAP score of 0 and 2 patients (2%) recorded a score of 1 for pain during
101 delivery of Sub-Tenon's anaesthesia. This resulted in a mean VAP score of 0.02, or
102 effectively 0 for the purpose of this study. None of the patients (n=100, 100%) felt any pain

103 during the surgery with an average surgical time of 25 minutes. There was no intra or
104 postoperative complications (up to 1 month post surgery) due to anaesthesia recorded in our
105 series.

106

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

110 4. DISCUSSION

111 Srinivasan et al [9] report mean VAP scores of 2.42 taken immediately after cataract
112 surgery with Sub-Tenon's anaesthesia in a randomised clinical trial comparing topical and
113 Sub-Tenon's anaesthesia. Similarly Zafirakis et al [7] report a mean VAP score of
114 1.53(SD0.63) for delivery of anaesthesia and 0.57(SD1.28) during surgery.

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

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

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

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

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

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

151

152

153 **4. CONCLUSION**

154

155 Our results show that we have met if not surpassed our prescribed standards and the goals
156 set out by the Royal Colleges in terms of providing pain free intraocular surgery. There were
157 also no complications arising as a result of this technique.

158 The additional cost advantage in the setting of the modern financially constrained NHS can
159 also not be overlooked with the cost of delivery per anaesthetic cocktail per patient being
160 £9.11 per patient for the lignocaine-bupivacaine-hyalase combination regime and only £0.17
161 per patient with our suggested regime.

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

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169 them for their cooperation and feedback.

170

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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239 **DEFINITIONS, ACRONYMS, ABBREVIATIONS**
240 Nil required.
241
242 **APPENDIX**