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MINIMISING VENOUS CANNULATION PAIN: COMPARISONOF 'RAW' 22 GAUGE VENFLON CANNULATION VERSUS THAT OF LIGNOCAINE INJECTION USING EITHER A 25 GAUGE OR 29 GAUGE (DIABETIC) NEEDLE PRIOR TO CANNULATION

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ABSTRACT

INTRODUCTION: *EMLA cream or a pre-cannulation injection of lignocaine are mostly used to attenuate pain of cannulation, despite pain associated with lignocaine injection. Others claim minimal iatrogenic discomfort when inserting a 22 gaugeVenfloncannula without EMLA or lignocaine injection (raw cannulation). The efficacy of reducing pain by injecting lignocaine through an ultra-small 29 gauge 'insulin' needle has not been studied to date.This prospective, observational audit compared pain responses to raw cannulation using a 22gaugeVenflon, with that caused by injecting lignocaine either through the conventional 25gauge needle (as control) or via a 29gauge insulin (diabetic) needle (as test group), prior to venous cannulation using a 20gauge Venflon in both latter groups.*

METHODS: *Three groups of 66 patients each were audited. Subjective (using a visual analogue pain scale: 0 = no pain, 10 = severe pain) and objective pain responses (vocalization, grimace, any movement) were recorded to raw cannulation, lignocaine injection and, in the 29gauge needle group, following insertion of a 20 gauge Venflon after lignocaine injection.*

RESULTS*: Similar low incidences of objective pain occurred in the three groups, and in the 20gaugeVenflon post-29 gauge needle/lignocaine injection sub-group. Subjective pain responses occurred both with greatest incidence (χ^2 =5.87, $p<0.0125$) and overall number of responses ($\chi^2=12.59$, $p<0.0125$) in those cannulated raw compared with those given lignocaine through a 25 gauge needle. In the latter group,the least overall pain response to cannulation occurred compared to both raw cannulation ($\chi^2=12.59$, $p<0.00025$) and cannulation after 29gauge needle/lignocaine injection ($\chi^2=5.87$, $p<0.0125$).*

CONCLUSION: *This study strongly suggests that 'raw' cannulation using a 22 gaugeVenflonis marginally more painful than cannulation following the administration of lignocaine using either the standard25gauge or 29 gauge test 'insulin' needle, and confirms that lignocaine injection does not totally obtund subsequent venous cannulation pain*

KEY WORDS: *Cannulation, Needle, Venflon, Lignocaine*

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INTRODUCTION

The use of an Anaesthetic cream or gel(EMLA cream, Astra Pharmaceuticals or AMETOP gel, Smith and Nephew [1] or an injection of lignocaine of any concentration [2], though mildly painful[3] minimises the pain of venous cannulation associated with insertion of the routinely used 18, 20 and 22 gauge cannulae[4,5]. Despite this, many colleagues favourinserting a22gaugeVenflon, without prior administration of lignocaine, for simplicity sake and the minor discomfort inflicted. While it has been demonstrated that injection of lignocaine via a 25 gauge needle is less painful that the insertion of a 22gauge Venflon[4], a comparison of the pain of injection of lignocaine using the very fine 29 gauge (BD Safetyglide TM insulin) needle has not been compared either with that of the 25gauge needle or with 'raw'cannulation using a 22 gauge Venflon.

The prevalence of needle-phobia and disquiet among many anaesthetists of inflicting iatrogenic pain has led to recentattempts tominimise this discomfort. These includeboth identifying risk factors predictive of difficult cannulation [6], describing techniques of how to inject local anaesthetics in an almost pain free manner based on solution selection, preparation, equipment choice, patient education, topical site choice, preparation and technical procedures [7]and new strategies, not universally available, to minimise the pain of cannulation.These include the use of aneedle-free powder lignocaine delivery system, proven effective in children [8] and adults [9], and the use of <2mm microneedles [10] to inject medications(insulin, vaccines, analgesics and local analgesics) sub-dermally with minimal pain. Similarly, the traditional use of vaso-coolant sprays has been re-examined, with mixed results, being found to be more effective in children [11] but only marginally so in adults [12].

This prospective, observational, study was undertaken to compare the pain of the traditional subcutaneous injection of lignocaine viaeither a conventional 25gauge needle or a test 29 gauge 'insulin' needle prior to venous cannulation with a 20gauge Venflon, with the pain of dermal puncture and venous cannulation associated with the insertion of a 22gauge Venflon without prior injection of lignocaine ('raw cannulation')as a third comparator.

METHOD

The audit was approved by the Central Gippsland Health Research and Ethics Committee (Sale Hospital (Attachment1). Verbal consent at the time of venous cannulation was approved, instead of a written informed consent. One hundred and ninety-eight successive American Society of Anesthesiologists Classification (ASA) 1-3 patients presenting to Sale General Hospital, Victoria, Australiafor routine in- and outpatient surgery were audited from September through December 2000.Each was randomly allocated, using a specific computer-generated block-randomisation chart to one of three groups 1) to receive raw venipuncture with a 22gauge Venflon, 2) to receive pre-cannulation subcutaneous (S/C) injection of lignocaine injected through a 29gauge insulin needle, or 3)to receive pre-cannulation lignocaine injected though a 25gauge needle, with a 20gauge Venflon being inserted in the latter two groups.

The patients were pre-medicated or not, according to wishes canvassed at the pre-operative assessment [13,14], were advised of the audit, and individual verbal consent obtained. Those selecting an inhalational induction of anaesthesia were excluded from the audit[15]. On arrival in the pre-operative holding area, or operating room, a rubber tourniquet was applied to the non-dominant upper arm (usually, occasionally the other) and the skin on the dorsum of the hand cleansed with an alcohol wipe and allowed to dry. The dorsum of the non-dominant hand was the site of first choice for cannulation because of a demonstrated lesser sensitivity of this area for cannulation [16].

The patient, blind to the procedure, then received either raw cannulation using a 22gaugeVenflon, or a subcutaneous injection into the skin over an appropriate vein of 0.25mL lignocaine 2% without adrenaline, injected through either a 25 gauge or 29 gauge 'insulin' needle. Thirty seconds following the latter, a 20gaugeVenflon was inserted. During the cannulation process, the anaesthetist and the assistant nurse assessed pain experienced by the patient both 1) subjectively, by asking the patient to rate the pain experienced using a verbal analogue scale of from 0 = no pain to 10 = very severe pain and 2). objectively, by recording any patient responses (grimacing, vocalisation, hand/arm/leg movement) during dermal puncture.

A number needed to treat estimate suggested that about sixty patients per group are required for a 25% difference between groups for statistical significance, with 80% power, two-tailed and standard alpha error. Unpaired Student's t-test and Chi squared tests were used as appropriate.

As the audit became established, it became apparent that, despite having received a pre-cannulation injection of lignocaine, many patients experienced subjective and objective pain responses to subsequent insertion of a 20gaugeVenflon. Accordingly, those in the 29gauge lignocaine group were audited both for the pain of inserting a 29gauge needle to inject lignocaine and of any sensation during subsequent venous cannulation using a 20gauge Venflon.

RESULTS

Randomization with respect to the 22gauge cannula, 25gauge and 29gauge 'insulin' test needles produced three patient study groups of 66 patients each. These were comparable for sex, age, weight and ASA status. Age ranged from 18 to 88 years (mean 55 years), with similar mean ages and bodyweight in the three study groups (Table 1:Characteristics).

The subjective mean pain scores of 2.04(SD 2.03), 1.80(SD 1.80), and 1.7(SD 1.58) in the raw 22 gauge Venflon, 25 gauge needle and 29 gauge needle groups, respectively, and of 0.45(SD 0.82) in the subgroup of the 29 gauge needle group in whom subjective pain was canvased during 20 gauge cannulation after lignocaine injection (Group 3b,Table 2) were all similar.

Nineteen (29%) patients in this latter subgroup (Group 3b) described additional pain during insertion of the20gaugeVenflon after having received an injection of lignocaine through a 29 gauge 'insulin'needle.

The numbers of patients objectively responding (grimacing, vocalising, moving) during needle insertion and injection of lignocaine were similar in the 25 gauge (N=2) and 29 gauge (N=7) groups, respectively. However, the overall number of responses in the 29 gauge group (N=10) significantly exceeded the total number of responses (N=2) in the 25 gauge group ($\chi^2 = 5.87$, $p<0.0125$, Group 2 versus Group 3 in Table 2).

The number of patients objectively responding and their total number of responses (N=10 and N=16, respectively) in the raw 22 gauge cannula group were similar to the number of responders (N=7) and total number of responses (N=10) in the 29 gauge group (Group 1 versus Group 3a in Table 2)

Table 1: Patient Characteristics

	Group 1	Group 2	Group 3a	Group 3b
	22G Venflon	25G needle/ligno.	29G needle/ligno.	20G Venflon after 29G needle/ligno.
N (male;female)	66(34:32)	66(26:40)	66(37:29)	66(37:29)
Mean age (SD) years	56(17)	64(15)	55(20)	55(20)
Mean weight (SD) kg	84(17)	81(16)	88(22)	88(22)
ASA (N=1 v N=2+)	24:42	28:38	25:41	25:41
p-value (all comparisons)	ns	ns	ns	ns

Data given as: ligno=lignocaine, N= patient number, SD= standard deviation, kg= kilograms, ASA=American Society of Anesthesiologists, p=probability, ns=not statistically significant. Numeric data rounded off to whole numbers. Student's 't' tests and Chi-squared tests used for analyses.

Table 2 – Patient Pain Response to Dermal Puncture and Cannulation

Subjective Response	Group 1	Group 2	Group 3a	Group 3b
Mean pain score	2.04(2.03)	1.8(1.8)	1.7(1.58)	0.42(0.87)
p-value	ns	ns	ns	ns
Objective Response				
N. responding	10(15%)	2(3%)	7(11%)	3(5%)
p-value	χ^2=5.87, p<0.0125		ns	ns
Total responses	16(24%)	2(3%)	10(15%)	5(8%)
p-value	χ^2=12.59, p<0.00025		χ^2=5.87, p<0.012	ns

(Data given as: N=patient number; SD = standard deviation; ASA = American Association of Anaesthetists; p= probability; ns = not statistically significant; ligno.= lignocaine). Numeric data rounded off to whole numbers. Student t-tests used for mean (SD) comparisons; Chi-squared tests used for patient number comparisons.

DISCUSSION

This prospective audit was undertaken in the wake of four previous studies of venous cannulation in which general factors of sex, age, vein site, nature of premedication, use of small gauge Butterfly (Abbott) needles or Venflons, use of a pre-cannulation injection of lignocaine with or without adrenaline and the skin sensitivity of the arm were audited [5,17]. Accordingly, the dorsum of the hand, one of the two least sensitive sites on the arm, was selected for all venous cannulations. Patients received anxiolytic pre- medication according to preference [13,14] and were block randomized to one of the three intervention groupsfor comparability of groups. Lignocaine without adrenaline was used exclusively, though lignocaine with adrenaline is equally efficacious [5] for this purpose.

Intravenous, rather than inhalational ("mask") induction of anaesthesia, remains most popular with anaesthetists, despite an extensive literature in both children and adults showing both the safety of sevoflurane by mask for induction of anaesthesia[15]and the frequency of 'needle-phobia' with a preference for a 'mask'induction expressed by many patients. 53% of American children [18], 41% of Australian women [19], 50% of American adults [20] and 20% of British adults [21] admit to 'needle-phobia' and a preference for a 'mask' induction of anaesthesia. Though readily available, the use of

topical analgesic creams to reduce cannulation pain is not routine and is usually only used in the very needle-phobic. Lignocaine injection prior to cannulation is the routine alternative by manyanaesthetists sensitive to this common, iatrogenic source of worry and pain to patients. Further to this, the relative unavailability of vaso-coolants and needle-free powder lignocaine delivery systems is such that lignocaine injection prior to cannulation is most commonly used.

Despite the widespread availability of the 29 gauge (BD insulin) needle and its routine use by diabetics to painlessly inject insulin, no data appears to describe its use to minimise the pain of injecting lignocaine prior to venous cannulation. Further to this, although the 22gaugeVenflon has been shown to cause more pain if inserted without prior lignocaine injection [4], it's solo use is popular because of its simplicity, longevity and ability to infuse IV fluids with minimal discomfort when inserted.

Though use of the 22gaugeVenflon may be convenient, although it does cause some, albeit minimal pain on insertion. Since the efficacy of reducing cannulation pain by using the ultra-fine 29gauge insulin needle for lignocaine injection prior to venous cannulation, thisaudit was undertaken to determine if the discomfort of dermal puncture and venous cannulation caused by 'raw cannulation' with a 22 gauge Venflon (without prior injection of lignocaine), is such that the time and expense of preparing and administering an injection of 0.25 mL of plain 2% lignocaine through a 29 gauge (BD insulin) needle, as well as through the more usually used 25 gauge(BD) needle, prior to insertion of a 20 gauge Venflon, is advantageous.

Surprisingly, the subjective mean pain scores for venous cannulation in the three test groups were statistically similar, suggesting that the ease of 'raw' cannulation with a 22gaugeVenflon is sufficiently patient-friendly to be warranted routinely in suitable patients. More surprising, is the finding that the .mean pain score of those being cannulated with a 20gaugeVenflon after prior injection of lignocaine is also similar to the pain reported in the three main test groups. This suggests that lignocaine is more efficient in attenuating sharp pain sensation and is less so in attenuating subsequent stretch and pressure sensations, such as skin and vein distension by large bore cannulae.The observation that lignocaine appears not to negate pressure and stretch sensation is observed in dental and maxillofacial surgery [22].

The expectation that lignocaine injection through the very small 29gauge insulin needle would be least painful was not realized. Though this is fortuitous from a cost and manpower standpoint, it confirms that lignocaine injection itself causes a temporary, self-limiting discomfort, too. However, more fortuitous, is thefinding that the usually used 25gauge needle is equally, or more,efficacious for this purpose.

A limitation of this study is that 29gauge'insulin' needles (including vaso-coolant sprays, needle-free powder lignocaine equipments and micro-needles) are not usually readily available in operating rooms or pre-operative holding areas. A further weaknessof the audit is that the 25gauge needle was not assessed separately for boththe dermal needle penetration come lignocaine injectionand the subsequent venous cannulation sensation, as was performed with the 29gauge needle.

In conclusion, although the subjective mean pain scores in the test groups were similar, the greater incidence of objective pain responses in those undergoing 'raw'22gauge cannulation suggests that 'raw' cannulation is marginally more painful than cannulation following lignocaine injection prior to cannulation technique. The 29gauge insulin needle, when so used, was less cost effective and no more effective than the 25gauge needle in this regard, and is not recommended for this purpose.

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COMPETING INTERESTS

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REFERENCES

1. *Maunuksela E-L, Korpela R. Double-blind evaluation of a lignocaine-prilocaine cream (EMLA) in children. Effect on the pain associated with venous cannulation. Br J Anaesth 1986; 58:1242-45.*
2. *Criswell J, Gauntlett IS. Pain on intradermal injection with lignocaine. The effect of concentration. Anaesthesia 1991; 46:692-92.*
3. *Morris R, McKay W, Mushlin P. Comparison of pain associated with intradermal and subcutaneous infiltration with various local anaesthetic solutions. AnesthAnalg 1987: 66: 1180-2.*
4. *Harrison N, Langham BT, Bogod DG. Appropriate use of local anaesthetic for venous cannulation. Anaesthesia 1992; 47;210-12*
5. *van den Berg AA. Rationalising venous cannulation: patient factors and lignocaine efficacy. 6naesthesia 1993; 48:84.*
6. *Pinedda M, Biagioli V, Barella B, CarpisassiI, Ghinelli R et al.Factors affecting difficult peripheral intravenous cannulation in adults. J Clin Nurs 2017; 26(7-8): 1074-1084.doi:10.1111/jocm 13444. Epub 2017Feb7.*
7. *Strazar A, Robert MD, Leynes GB, Lalonde DH. Minimising pain of local anesthesia injection. Plastic and Reconstructive Surgery 2013 September; 132(3):675-84.*
8. *Gupta J, Park SS, Brandy B, Felner EI, Prausnitz MR. Infusion pressure and pain during microneedle injection into the skin of human subjects.Biomaterials2011 October;32(28): 6823-31.*
9. *Zempsky WT, Bean Lijewsky J, Kauffman RE, Koh J. Needle-free powder lignocaine delivery system provides rapid effective analgesia for venipuncture or cannulation in children: Randomised, doubly blind comparison of venipuncture pain and venous cannulation after fast onset needle-free powder lignocaine or placebo treatment trial. Pediatrics 2008 June 121(5): 979-87 DOI:10.1542/peds.2007-0814.*
10. *Zempsky WT, Schmitz ML, Meyer JM. Safety and efficacy of needle-free powder lignocaine delivery system in adult patients undergoing venipuncture or venous cannulation: A randomized, double-blind, placebo-controlled trial. Clin J Pain 2016 March;32(3):211-7.*
11. *Hogan ME, Smart S, Shah V, Taddio A. A systematic review of vasocoolants for reducing pain from venipuncture and venous cannulation in children and adults. J Emerg Med 2014 December 47(6):36-49 doi: 10.1016/j.jemermed. 2014. 06 .02 .Epub 2014 Aug29 .PMID 25168120.*

12. *Mace S. Prospective, randomized, double-blind, controlled trial comparing vasoactive coolant spray vs placebo spray in adults undergoing venipuncture. Am J Emerg Med 2016 May; 34(5):798-804 doi: 10.1016/j ajem. 2016.01.002. Epub 2016 Jan 7.*
13. *Van den Berg AA. "Patient-centred" anesthesia planning rationalized by pre-operative patient preferences. AnesthAnalg 2010; 110; S-1-S-491.*
14. *van den Berg AA, Sadek M, Swanson S. Patient wishes regarding pre-anaesthetic medication ("premedication") in pre-operative surgical wards and short-stay units: a guide to practice. Australian Society of Anaesthetists 61st National Scientific Congress 26-30 October 2002, Congress Handbook.Sunday 27 October, Adelaide 2002. Session 5c. Free papers.*
15. *Van den Berg AA. Sevoflurane induction of anaesthesia (SIA): a years's experience rationalises "needleless induction of anaesthesia".Acta Anaesthesiol Scand 2001;115;45; P3-3:55.*
16. *Van den Berg AA. Skin sensitivity of the arm. A comparison of sites. Anaesthesia 1996; 51:194-7.*
17. *Van den Berg AA, Prabhu NRV. Rationalizing venous cannulation: comparison of lignocaine injection, Butterfly (21 and 23 Gauge) and Venflon 20Gauge. AnaesthIntens Care 1995;23:165-7.*
18. *Van den Berg AA, Muir J.Inhalational or intrravenous induction of anesthesia in children? An audit of patient and parent preference. Anesth Clinic Res 2011. 2:6 DOI:10.4172/2155-6148.1000156.*
19. *Van den Berg AA. Intravenous (IV) versus inhalational induction of anesthesia using sevoflurane in adults (SIA): a rationalization for "needleless" induction guided by patient choice. AnesthAnalg 2002 Abstracts; 94; S-1-S-3:S10.*
20. *.Van den Berg AA, Chitty DA, Jones RD, Sohel MS, Shahen A. Intravenous or inhaled induction of anesthesia in adults? An audit of preoperative patient preference. AnesthAnalg 2005:100(5); 1422-4.*
21. *Van den Berg AA. 20% of British adults choose inhalational ("mask") rather than intravenoue ("needle") induction of anaesthesia: towards "patient centredanaesthesia practice". Eur J of Anaes 2008; 25: 22-23.*
22. *Krishnan, M.K. Dental Surgeon. Personal communication.*