Efficacy of the jet injector in local anaesthesia for small wound sutures: a randomised clinical trial compared with the needle infiltration technique

Bijan Saghi,1 Mehdi Momeni,2 Morteza Saeedi,2 Mohammadreza Ghane3

ABSTRACT

Background Despite advances in the application of needle free devices in medical procedure, there is a paucity of knowledge on the efficacy of the jet injector for suturing skin wounds.

Aims Our study aimed to compare the severity of pain and time to initiation of anaesthesia between two methods of local anaesthesia for skin suturing of small facial wounds.

Methods We conducted a double blind randomised clinical trial between December 2012 and February 2013 at a university hospital in Tehran, Iran. 53 patients with small facial wounds needing skin closure with sutures were assigned to either the jet injection group or the needle infiltration group. Pain severity after administration of local anaesthesia and during the stitching procedure, and time to initiation of skin numbness were evaluated.

Results Mean pain score during the anaesthetic procedure was 1.1±1 in the jet injector group compared with 4.4±1.4 in the needle infiltration group (p<0.0001). Moreover, time to initiation of local numbness was significantly longer in the jet injection group than in the needle infiltration group (p<0.0001). Nevertheless, suture procedure related pain scores did not differ significantly between the two groups (p>0.05).

Conclusions The jet injector is an effective device in reducing the pain of the anaesthetic procedure for small facial wounds. However, the remarkably lower pain should be evaluated in light of other parameters, including acceptance and preference of the newly introduced technique.

Trial registration No IRCT201201308872N3.

INTRODUCTION

With recent advance in anaesthesiology, every medical procedure can be performed with as little pain as possible.1–4 Skin wound suture is a painful procedure, performed regularly in many patients admitted to the emergency room all over the world. Local anaesthesia has been used as the standard preparation method before suturing the skin wound in the outpatient setting because it is a safe mechanism of drug delivery and has a relatively rapid onset of anaesthetic effect. However, for many patients, delivery of local anaesthetic agents via needle infiltration provokes anxiety or discomfort.2 4 9 10 Also, administration of intradermal or subcutaneous lidocaine through needle injection is not easily applicable in some groups of patients, especially the paediatric population.4 10 11

Jet injection is a painless drug administration technique and has been used as an easy method of vaccination for highly contagious disease.12 13 It has been used as a tool for administration of heparin, midazolam, ketamine and intradermal anesthetics.14 The safety, efficacy and costs of jet injection for local anaesthesia before performing intravenous catheterisation, fine needle aspiration biopsy for palpable breast mass, male vasectomy and dentistry procedures has recently been studied.1–4 6 9 12 However, there is a paucity of knowledge regarding the efficacy of the jet injector in local delivery of lidocaine for suturing skin wounds. The jet injector is safe, it does not have sharp edges and there is no threat of needle stick injuries. It can also be safely disposed of in a normal waste container. In addition, it does not cause trauma, infection or pain, and can be reused many times.

The aim of our study was to compare pain levels and initiation of action between two methods of local anaesthesia for skin suturing of small facial wounds.

METHODS AND MATERIALS

Study design

This was a double blind randomised clinical trial conducted between December 2012 and February 2013 at a university hospital in Tehran, Iran. We recruited patients with small facial wounds referred to the emergency department. The institutional review board of the Tehran University of Medical Sciences approved the study protocol on human subjects.

Patients

Inclusion criteria were small facial wounds <3 cm in patients older than 18 years of age requiring stitches. Patients with infected or contaminated wounds, a decreased level of consciousness or already receiving sedative or analgesic medication were excluded from the study. All patients gave written informed consent before entering the study.

Randomisation and blinding process

Using a computer generated series of random numbers, eligible patients were randomly allocated to either the jet injector group (intervention group) or the needle infiltration group (control group). Patients were asked to keep the eyes closed for the whole procedure: they were covered with sterile gauze, given anaesthesia and the suturing procedure performed. Additionally, the physician performing the sutures was blinded to the method used for local anaesthesia.
Anaesthetic technique
The investigator responsible for randomisation of the study subjects performed anaesthesia in both groups. In the intervention group, a needle free jet injector device was used, consisting of a storing syringe fitted with an injector, powered by a cartridge containing compressed carbon dioxide. The syringe holds 1 mL of 1% lidocaine, and the charged cartridge delivers 10 injections. At a distance of 1–2 cm above the skin, the jet injector is activated once for each 1 cm² of injured area. For the control group, local anaesthesia was similarly performed using a 25 gauge needle and a 2 mL syringe, which is the routine anaesthetic method used in our ward.

Suturing technique
Following initiation of the anaesthetic effect, the skin wound was sutured similarly in both groups with 3-0 nylon thread under sterile conditions. Wound dressing was done when the stitching was completed and there was no further bleeding or signs of wound disruption.

Endpoint definition
The primary endpoint of this study was pain level at the time of local anaesthetic administration. Time to initiation of wound anaesthesia and severity of pain during the suture procedure were considered secondary endpoints.

Outcome measurement
Patients rated their pain severity on a 10 point Likert scale using a visual analogue scoring system. Score 1 refers to the least amount of pain while a score of 10 points indicates the most severe pain. Time to local anaesthesia was measured by examination of point sensation with a 1 gauge needle every 1 min following administration of the local anaesthetic agent.

Statistical analysis
Data were analysed using the Statistical Package for Social Sciences (SPSS, V.16). The Student’s t test was used for continuous variables and the χ² test for categorical variables. Statistical significance was achieved when p<0.05.

RESULTS
A total of 53 patients were enrolled in this study of which 26 were assigned to the jet injection group and 27 to the needle infiltration group. Patient demographics and clinical features are summarised in table 1. There was no statistically significant difference between the two study groups for patient characteristics or for clinical or anatomical wound features.

Mean pain score during the anaesthetic procedure was 1.1±1.0 in the jet injection group compared with 4.4±1.4 in the needle infiltration group (p<0.0001). Moreover, time to initiation of local numbness was significantly shorter in the needle infiltration group than in the jet injection group (p<0.0001). Nevertheless, suture procedure related pain score did not differ significantly between the two groups (p>0.05). The study outcomes in the two groups are compared in detail in table 2.

DISCUSSION
Our study revealed that application of a needleless injecting system can anesthetise the wound site with less pain than conventional needle infiltration, although with a longer duration for initiation of numbness. Nevertheless, it should be noted that there was no significant difference between the two techniques in overall pain level, and there was no superiority in efficacy of local anaesthesia with either device. This finding is in keeping with other studies which have documented a significant decrease in pain following jet injection.2–4 However, to the best of our knowledge, no study has measured the efficacy of needleless jet injection of lidocaine in stitching small wounds of the face.

Table 2 Comparison of study outcomes between the two groups

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Jet injection group (n=26)</th>
<th>Needle infiltration group (n=27)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthesia related pain</td>
<td>1.1±1.0</td>
<td>4.4±1.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Suture related pain</td>
<td>2.3±0.8</td>
<td>2.1±1.1</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Time to initiation of numbness (min)</td>
<td>3.1±1.6</td>
<td>1.7±0.9</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 1 Patient demographics and clinical features in the two groups

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender (n (%))</th>
<th>Male</th>
<th>Female</th>
<th>Wound length (cm)</th>
<th>Wound depth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.3±1.8</td>
<td>Gender (n (%))</td>
<td>14</td>
<td>12</td>
<td>1.7±0.7</td>
<td>3.5±0.6</td>
</tr>
<tr>
<td>45.1±1.6</td>
<td>Male</td>
<td>53.8</td>
<td>46.2</td>
<td>1.6±0.5</td>
<td>3.7±0.5</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>48.1</td>
<td>51.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

is noteworthy that in their study, patients rated the jet injector in their second dental session, 1 week after they had undergone their first procedure under needle infiltration anaesthesia. Moreover, scoring by children may differ from that of adults.

The limitations of the current study include the high workload and stressful environment of the emergency room, which may inappropriately affect the reliability of endpoint measurements. Moreover, a larger study population may be needed to avoid statistical type 2 errors. Future studies should consider different types of jet injectors when evaluating the anaesthetic effectiveness of needleless devices.

CONCLUSION
The jet injector is an effective device in reducing the level of pain of the anaesthetic procedure in small facial wounds. However, the remarkably lower pain should be evaluated in light of other parameters, including acceptance and preference of the newly introduced technique.

Contributors MS: study design and supervision. BS: data gathering and drafting. MM: data interpretation and gathering. MG: critical revision.

Competing interests None.

Ethics approval The institutional review board of the Tehran University of Medical Sciences approved the study protocol on human subjects.

Provenance and peer review Not commissioned; not externally peer reviewed.

REFERENCES
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Correction

In the paper, Saghi B, Momeni M, Saeedi M, et al. Efficacy of jet injector in local anesthesia for small wounds sutures; A randomised clinical trial comparing with needle infiltration technique, the dates of patient enrolment were incorrectly listed as December 2012 - February 2013; in fact, the dates of enrollment were February 2013 - May 2013. The jet injector was placed 1-2cm from the skin (not 5 cm as stated in the published paper). The study was confined to patients 18-65 years old. These corrections are now consistent with the registered protocol IRCT201302108872N3. The protocol states the study would be conducted on patients with wounds, but the paper correctly states that the study was confined to patients with facial wounds.
