Clinical Neurology and Neurosurgery 125 (2014) 137–142

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Octyl-cyanoacrylate skin adhesive is effective for wound closure in posterior spinal surgery without increased risk of wound complications

Brian M. Howard[a,b,*], Sheila R. Eshraghi[a,b], Christopher M. Holland[a,b], Daniel Refai[a,b,c,d]

[a] School of Medicine, Emory University, Atlanta 30322, USA
[b] Department of Neurological Surgery, Emory University, Atlanta 30322, USA
[c] The Emory Spine Center, Emory University, Atlanta 30322, USA
[d] Department of Orthopedic Surgery, Emory University, Atlanta 30322, USA

ARTICLE INFO

Article history:
Received 7 May 2014
Received in revised form 6 July 2014
Accepted 20 July 2014
Available online 2 August 2014

Keywords:
Spine surgery
Surgical site infection
Wound closure
Cyanoacrylate skin adhesives
Wound complication

ABSTRACT

Objective: Few published studies have examined the complication profile after posterior spinal surgery wherein absorbable, subcuticular suture and cyanoacrylate skin adhesives (CSA) were used for incision closure. The purpose of this report is to compare the rate and profile of wound complications in a large number of patients who underwent posterior spinal surgery with CSA skin closure to rates of similar complications with standard nylon closure techniques.
Methods: The prospective database of all surgical cases maintained by the senior author was retrospectively reviewed. Three hundred eighty-two patients underwent posterior spinal surgery for degenerative, oncologic and traumatic pathology. Wound-related complications, including cerebrospinal fluid leak, wound infection and dehiscence were analyzed in all patients.
Results: These data establish that the incisions in patients who undergo posterior spinal surgery can be safely and successfully closed with subcuticular Monocryl™ and CSA without increased risk of CSF leak, wound infection or dehiscence. Rates of these complications were similar between the study population, a small subset of patients treated with traditional closure techniques and those in the established literature.
Conclusions: CSA is a safe method to achieve ultimate skin closure in patients who undergo posterior spinal surgery without increased risk of wound-related complications, even in those patients undergoing intradural procedures.

1. Introduction

Few articles have been published evaluating the complication profile after posterior spinal surgery using cyanoacrylate skin adhesives (CSA) for wound closure [1–4]. CSAs were initially developed in the 1940s and their use for surgical wound closure has been widely reported beginning in the 1970s in multiple disciplines [5,6] including neurosurgery [1–4,7]. Cyanoacrylate has theoretical advantages over conventional suture closure in that no dressing needs to be applied over the incision, it is immediately waterproof, no suture has to be removed and patients are often more satisfied with the cosmetic result [2,3]. However, only a single, recent cohort study has analyzed whether the use of CSA for posterior spinal surgery wound closure is as safe and effective as traditional closure techniques [4].

Adequate closure is a sine qua non to prevent post-operative wound complications. Typically, the skin is reapproximated with a running nylon closure in posterior spine surgery, particularly when the dura is inadvertently violated or purposefully opened to address intradural pathology. We propose that incisions for posterior spine surgery can be closed with running, subcuticular 4-0 poliglecaprone suture followed by epidermal application of CSA with no increased incidence of wound-related complications when compared to published rates for standard closure types. This study is only the second reported large series of patients who underwent posterior spinal surgery and wound closure with CSA and is the only series that includes a large number of patients who had procedures for spinal tumors, including intradural pathology.

* Corresponding author at: Department of Neurological Surgery, 365-B Clifton Road, Suite 6200, Atlanta, GA 30322, USA. Tel.: +1 404 778 5969; fax: +1 404 778 6310.
E-mail address: brian.howard@emory.edu (B.M. Howard).

http://dx.doi.org/10.1016/j.clineuro.2014.07.026
0303-8467/

2. Methods

This study was approved by the Institutional Review Board at the Emory University School of Medicine and was conducted in accordance with the Health Insurance Portability and Accountability Act. The authors have no financial conflicts of interest to disclose.

2.1. Patient selection

The prospective database of all surgical cases maintained by the senior author was retrospectively reviewed. From over 900 consecutive patients treated, a cohort of 382 patients who underwent posterior spine surgery, excluding sacral operations, with a minimum of 12 months follow-up were culled. Seventeen patients were excluded from the study: five patients were lost to follow-up, 1 patient did not have sufficient data within the accessible medical record for adequate analysis and 11 patients underwent initial surgery for osteomyelitis/diskitis. Therefore, a total of 365 patients and 380 total cases were evaluated (Table 1).

2.2. Surgical technique

All patients were positioned prone, in the manner typical for surgery at the relevant segment of the spine. The senior author, exclusively, performed a standardized skin preparation on 100 percent of the patient population. Specifically, the surgical site was cleaned of debris and dermal oils using 70 percent isopropyl alcohol. The skin was then twice sterilized using 4 percent chlorhexadine gluconate surgical skin preparation solution (Chloraprep™, CareFusion, San Diego, CA, USA). All patients received 2 g of intravenous cefazolin within 1 h of skin incision unless they were allergic to penicillins or cephalosporins, in which case vancomycin was administered (1 g for patients less than 90 kg and 1.5 g for those greater than 90 kg). Antibiotics were redosed every 3 h intraoperatively and were continued for a minimum of 24 h postoperatively. For intradural cases, the dura was closed primarily using 4-0 nurolon™ suture (Ethicon, Somerville, NJ, USA) in the simple running fashion. Valsalva was held at 40 cm H_2O to assure no visible cerebrospinal fluid (CSF) leaks were noted. Leaks were patched using an autologous muscle patch secured using interrupted 4-0 nurolon™ suture. Fibrin sealant (Tisseel – Baxter, Deerfield, IL, USA or Evicel – Ethicon, Somerville, NJ, USA) was then applied over the exposed dura. The incision was then closed in the characteristic fashion by approximating the thoracolumbar or cervical fascia where appropriate using interrupted 0-guage polyglycolic acid absorbable suture. The dermis was approximated with 2-0 polyglycolic acid absorbable suture using standard inversion technique to bury the knots. Finally, 4-0 poliglecaprone suture (Monocryl™ – Ethicon, Somerville, NJ, USA) were placed intradermally using standard subcuticular technique and a layer of CSA (Dermabond™ – Ethicon, Somerville, NJ, USA or Secure-seal™ – Cardinal Health, Dublin, OH, USA) was then applied according to the manufacturer's instructions.

Table 1
Patient demographic data.

Total patients (*n*)	382
Lost to follow-up	5
Insufficient data	1
Osteomyelitis/diskitis cases	11
Total patients analyzed (*n*)	365
Total cases analyzed (*n*)	380
Age (yr)	
Mean	56.7
Range	17–89
Sex	
Male	189
Female	176
Degenerative disease cases (*n*)	291
Total tumor cases (*n*)	72
Bony/epidural	40
Intradural	32
Trauma cases (*n*)	17
Other cases (*n*)	10
Follow-up (months)	
Mean	16.2
Median	15.6
Range	13–36

Demographic data for all patients analyzed in this case series.

2.3. Outcomes

The outcomes of interest evaluated in this study were wound complications: namely CSF leak, and wound infection and wound dehiscence. Wound complication rates were compared to published rates for equivalently sized series of patients who underwent posterior spinal surgery with customary nylon or staple skin closure.

2.4. Statistical analysis

The rates of various wound complications were compared between patients whose incisions were ultimately closed with Monocryl™/CSA and those closed with either nylon or surgical staples by Fisher's exact test. *p*-value less than or equal to 0.05 was considered statistically significant. The association between dichotomous variables was similarly analyzed with contingency tables.

3. Results

Analysis of the prospectively maintained database of all cases completed by the senior author revealed 382 patients who underwent spine surgery from a posterior approach. After excluding patients by the aforementioned criteria, 380 cases were performed on 365 patients from July 2010 through April 2013. Demographic data is summarized in Table 1. The cohort consisted of 52 percent males ($n = 189$) and 48 percent females ($n = 176$). Mean age was 56.7 years (range: 17–89 years). Case distribution was robust across surgery types: 291 cases for degenerative disease, 40 for bony or extradural pathology, 32 for intradural pathology and 17 for trauma (Tables 1 and 2). Mean and median follow-up was 16.2 and 15.6 months, respectively (range: 13–36 months; Table 1).

The demographic data specific to each category of patients is detailed in Table 2. Well-established risk factors for post-operative infection [8–11] were assessed within each subgroup. The distribution of cases at the three spine regions evaluated (cervical, thoracic, lumbar) varied amongst the subgroups in an expected pattern. Spinal instrumentation was implanted in 131 of 291 (45 percent) cases for degenerative disease and 26 of 40 (65 percent) cases for bony or extradural tumors. A large percentage of patients, in whom instrumentation was used, were fused over 4 or more levels; 57, 75, 83 and 70 percent for degenerative, intradural, bony/extradural and trauma cases respectively. Revision surgery for tumors or trauma was exceedingly rare. In contrast, one out of every five cases for degenerative pathology was a revision.

Of the 32 cases in which a surgically planned durotomy was made to address intradural pathology, 30 were for tumors (Table 2). A single surgery was performed to fenestrate a symptomatic arachnoid cyst. The final surgery in the intradural subgroup was one in which the dura was surgically opened for a ventrally located mass lesion in the lumbar spine that appeared intradural on preoperative imaging. However, no mass was discovered upon exploring the lumbar intrathecal space and a free disk fragment was subsequently identified and excised. This case was included in the intradural