Lumbar Epidural Catheter Placement in the Presence of Low Back Tattoos: A Review of the Safety Concerns

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Current fashion in body art includes low back tattoos of varying designs and colors, a trend that presents unique concerns for anesthesia providers. Does the placement of epidural catheters risk the introduction of tattoo pigment dyes into the epidural space through the process of coring? Are there specific risks associated with tattoo dyes and epidural needle placement? We performed a comprehensive review of the literature using multiple search databases with the intent to form guidelines for practice using a level of evidence taxonomy. The available evidence does not identify any specific risks associated with epidural catheter placement through low back tattoos, although tissue coring with tissue transport to deeper sites has been confirmed. Continued investigation is necessary before comprehensive practice guidelines regarding the practice of placing epidural needles and catheters through lumbar tattoos can be developed. We suggest avoidance of piercing tattoos when performing epidural punctures until there is sound evidence of short-term and long-term safety.

Keywords: Epidural, evidence-based practice, pigment dyes, tattoo, tissue coring.

There is a long history of body tattooing in cultures throughout the world. The earliest accounts date back 5,300 years.1 Tattooing has had ceremonial, religious, tribal, and aesthetic connotations for individuals and societies, and is becoming increasingly popular in modern cultures. Included in this renewed popularity is the placement of low back tattoos, especially on women. Patients presenting for lumbar epidural catheter placement with low back tattoos have caused anesthesia practitioners to question the safety of needle and catheter placement through these sites.2-5 These concerns include the possibility of skin reactions, both acute and nonacute, and pigment coring. These concerns, as yet, have not been explored, and investigation of the potential risks is warranted.

A literature search was conducted using databases and search engines, including Cochrane Reviews, MEDLINE, PubMed, HighWire, and Google Scholar. Key terms and phrases included tattoo, permanent and henna, skin pigment, dyes, lumbar, epidural, tissue, coring, and risk. The paucity of evidence prevents the recommendation of specific practice guidelines. However, the evidence available promotes greater awareness of the concerns and potential risks associated with placing epidural catheters through the lumbar tattoo.

Skin Reactions
Tattoo dye pigments can cause acute and chronic skin reactions. The acute local skin reactions may be allergic, irritative, erythematous, pruritic, edematous, and infectious.6-12 The skin must be thoroughly examined before epidural insertion, and it is advised that epidural catheters not be inserted through, or near, tattoos that are reddened, inflamed, or exudative.13 Usually, established tattoos are free from acute inflammatory and infectious processes, but there exists the possibility of a chronic hypersensitivity and/or a delayed or hyperplastic reaction. Documented nonacute reactions to tattoo pigments include lichenoid, granulomatous, pseudolymphoma, and allergic reactions.14 Lichenoid reactions are psoriasiform or eczematous skin eruptions. Individuals with underlying skin disorders, such as psoriasis, sometimes exhibit an exacerbation, Koebner response, to tattoo placement.14 Conversely, individuals without underlying skin disorders may also experience lichenoid, granulomatous, and pseudolymphoma reactions. The skin appearance with a nonacute reaction may be raised (noduliform), scaly, exudative, reddened, and/or itchy. These symptoms often represent an ongoing inflammatory or immune response due to a pathogen or allergen. These pathogens, or allergens, have been identified through skin patch tests as compounds contained in tattoo pigments. Inflammatory or infective processes at the site of an intended epidural catheter placement is a contraindication to such placement.13
**Tattoo Pigment Coring**

The concern that tattoo pigments may be introduced into the epidural space through coring or channeling has prompted investigation. Coring is the process of removing a piece of tissue similar to how a hole-puncher perforates a piece of paper. The introducer needle may core a portion of pigmented tissues, and it may subsequently carry these pigments into the deeper tissues. Channeling involves a channel, or pathway, created in which pigment may migrate during the lumbar puncture. This possibility of coring and depositing pigment-containing tissues into epidural or subarachnoid spaces is the most often cited reason that some practitioners refrain from inserting epidural catheters in patients with back tattoos. Previous studies have shown the occurrence of tissue coring with needle punctures. Tissue coring of epidermal and fat tissues is a justifiable concern with epidural needle insertion as well as with any needle insertions. The presence of a stylet within spinal and epidural needles does not prevent tissue coring.

Tattoos lack federal regulation and proper identification of the compounds and elements in the dyes. The potential to core tattoo pigments and deposit them into deeper tissues or spaces, such as an intraspinal ligament, epidural space, and intrathecal spaces, may predispose the patient to additional risks. Coring may introduce carcinogenic and cytotoxic dye compounds to tissues that otherwise would not be exposed to these compounds. Pathologies caused by cores of tissues and contained compounds would not be immediately associated because they may take years to develop. Tattoo pigment has been found in axillary lymph nodes mimicking metastatic malignant melanoma 30 years after a tattoo placement.

**Tattoo Pigment Compounds**

Tattoos may be temporary or permanent, and each type contains different pigments. The potential harm or safety associated with epidural catheter placement through tattoos lies primarily in the chemical composition of the pigments used.

- **Temporary (Henna) Tattoos.** Temporary henna tattoos are a topically applied dye that colors the skin and ears. Henna is an orange-brown organic dye derived from the dried leaves of *Lawsonia inermis*, a shrub that grows in India, the Middle East, and North Africa, and is not highly allergenic. Henna is often diluted or substituted with paraphenylenediamine (PPD), a black color additive, which gives the temporary tattoo the darker appearance of a permanent tattoo. It has been well documented that localized skin reactions from temporary tattoos are associated with reactions to PPD and other aromatic para-substituted amino compounds. Specific mass spectrometry identification of the ingredients of a commercially available “henna” powder found PPD as the major ingredient and not lawsone (2-dihydroxy-1,4-naphtoquinone), the chemical that produces henna’s distinct color.

The clinical presentation of henna dermatis may include itching, papular and vesicular eruptions, erythema, and depigmentation. This may be seen with a first exposure or after multiple exposures. The reaction may be more severe in persons who have previously been sensitized to PPD from prior exposure to the ubiquitous hair and cosmetic dyes containing PPD. After a henna tattoo, PPD-induced dermatis may occur within hours or be delayed up to 4 weeks. Black or dark henna tattoos should raise suspicion for the presence of PPD. The frequent addition of PPD to henna tattoos, and the associated high incidence of contact dermatis, makes it prudent to avoid epidural catheter placement through these temporary tattoos.

- **Permanent tattoos.** Permanent tattoos have pigmented dyes that have been pierced into the dermis with needles. This procedure introduces the dyes into deeper levels of tissue, and natural skin shedding does not affect the tattoo integrity. Most permanent tattoo pigments are synthetically produced. The dye components may include organic and inorganic compounds, metals, and solvents. Some components that have been identified are titanium dioxide, iron oxide, and other heavy metals. The variation in chemical composition results in different colors for the tattoo designs (Table 1). Many pigments are not intended for use in humans, and the pigments are not regulated by federal agencies. Red pigments have been associated with the highest incidence of delayed reactions. A keratinizing squamous cell neoplasm contained within only the red pigmented area of a red and black tattoo has been identified. The red pigment was suspected to be the causative agent. Red dye composition includes mercury, aluminum, iron, calcium, titanium, silicon, and cadmium. Careful inspection of the entire tattoo should be carried out, and the integrity of the skin noted. When reactions occur, the causative agents may be more quickly identified when the type and color of the tattoo pigment is known. This identification is ultimately made by microanalysis.

**Discussion**

It was suggested that a pigment-containing tissue core may have been responsible for a 34-year-old parapertient’s lumbar interspace pain and tenderness several hours after an uneventful one-attempt epidural block. Although a definitive cause is not known for this lumbar irritation, it does encourage contemplation of possible tattoo tissue coring as a precipitating factor. Other case studies and clinical reports have found no evidence of negative sequelae associated with epidural needle insertion through tattoos. Many tattoo designs are not solid and have
areas of natural skin without pigments. This may offer a suitable pigment-free location for a regional anesthetic technique. Slight skin traction to distract the tattoo to one side may also provide a pigment-free area of skin. In addition, the paramedian approach may also be considered if it will provide a pigment-free area for needle insertion. It is, therefore, possible for epidural catheters to be placed through areas of skin without pigment even in the presence of lumbar tattoos (Figure).

However, large, complex, and multicolored tattoos may not provide an area of pigment-free skin. In these cases where undyed skin cannot be accessed, consideration must be given to the potential risk versus benefit. Discussion with the patient should be done for informed consent including this potential risk versus benefit. Some have suggested a skin incision before epidural needle insertion to prevent the potential for coring, but a skin incision will not eliminate the possibility of coring deeper tissues.

Evidence-based practice requires not only collection but also critique of data from which one may derive practice recommendations. Various types of data hold greater value than others. In general, randomized controlled trials (RCTs), meta-analysis of RCTs, and systematic reviews of RCTs are believed to be the strongest data (evidence), followed by cohort studies, nonrandomized clinical trials (non-RCTs), case reports, and last, expert opinion. High-quality meta-analysis and systematic reviews of unbiased RCTs consolidate evidence and promote reliable practice recommendations. Levels of evidence (LOE) are scored, most often using a numeric system that ranges from 1 to 4 or 5. The value of 1 correlates with strong, high-quality data such as a well-conducted, double-blinded RCT or a meta-analysis of multiple RCTs. The LOE scored at 4 or 5 (depending on LOE scale used) is of the weakest strength and consists of expert opinion. The purpose of scoring LOE is to allow the reader-practitioner to quickly identify the quality of the evidence and the value it contributes to guiding practice.

Several grading systems exist to qualify the strength, or level, of evidence that is used to guide practice. Recommendations to guide clinical practice based on LOE are usually graded alphabetically. An “A” grade is the strongest, highest quality recommendation based on LOE scored 1. The lowest grade, “D”, is based on nonanalytic studies, case reports, and expert opinion. Clinical practice recommendations scored “C” or “D” should not be solely relied on to guide practice.

Although the evidence is strong (LOE 2) for describing a causal effect for needle coring of biological tissues, no causal relationship of risk has been found when placing an epidural needle or catheter through tattoos. The available evidence does not support a framework that establishes that tattoos free from skin irritation and reactions may or may not be safely pierced for epidural catheter placement. The goal of strong evidence-based practice recommendations is not possible because of the weak strength and quality of studies exploring the risk of epidural catheter placement through tattoos. Only non-RCTs, case reports, expert opinions, and laboratory studies (levels 2, 3, and 4 evidence) exist. Evidence in the highest level (level 1), RCTs, is lacking, and therefore, a high-quality meta-analysis is not possible.

Despite the limited available evidence, some key points and conclusions may be stated. (Table 2). We make a general recommendation to avoid piercing tattoos when placing epidural catheters. This recommendation is ex-
trapolated from documented strong evidence that shows coring of biological tissues by spinal and epidural needles. Our extrapolation assumes that tattoo pigment coring may occur in the same manner as unpigmented biological tissue and transferred to the epidural or intrathecal space with dural puncture (wet tap). We acknowledge that this recommendation, because it is extrapolated from the evidence, is of weak strength, but it may be prudent to avoid piercing tattoos until more definitive research is done. Further study producing higher quality data to review and analyze is warranted. A large-scale retrospective study of outcomes may contribute to this endeavor.

Summary
The clinical questions: “Does the placement of epidural catheters risk introducing tattoo pigment dyes into the epidural space through the process of coring?” and “Are there specific risks associated with epidural puncture through tattoo dyes?” have only partially been answered. A strong evidence-based guideline for placing epidural needles and catheters through tattoos remains an unfulfilled goal. Although tissue coring has been well documented with needle punctures, coring of tissue by epidural needles with specific tattoo pigment transfer or migration has not been documented.

Avoidance of catheter placement through open, irritated, or infected areas remains a contraindication. Otherwise, epidural catheter placement through lumbar tattoos is a practitioner’s decision based on clinical judgment, institutional policy and procedure, and patient informed consent. It may be preferable to insert the introducer needle and catheter through skin that does not contain pigments. Many tattoo designs have areas that are not pigmented, and this gives the anesthetist the option of avoiding piercing a tattoo.

Our clinical suggestions, in summary, include awareness of the possibility of tissue coring with needle punctures, avoidance of piercing tattoos when possible, avoidance of epidural insertion at fresh tattoo sites (< 2 weeks old), and at sites of skin pathology, irritation, or infection.

REFERENCES

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