Evaluation of two different epidural catheters in clinical practice. Narrowing down the incidence of paresthesia!


Abstract: Although epidural anesthesia is considered safe, several complications may occur during puncture and insertion of a catheter. Incidences of paresthesia vary between 0.2 and 56%.

A prospective, open, cohort-controlled pilot study was conducted in 188 patients, ASA I-III, age 19-87 years, scheduled for elective surgery and epidural anesthesia. We evaluated a 20 G polyamide (standard) catheter and a 20 G combined polyurethane-polyamide (new) catheter. Spontaneous reactions upon catheter-insertion, paresthesia on questioning, inadvertent dural or intravascular puncture, and reasons for early catheter removal were recorded.

The incidence of paresthesia reported spontaneously was 21.3% with the standard catheter and 16.7% with the new catheter. Systematically asking for paresthesia almost doubled the paraesthesia rate. Intravascular cannulation occurred in 5%. No accidental dural punctures occurred. An overall incidence of 13.3% of technical problems led to early catheter removal.

The new catheter was at least equivalent to the standard regarding epidural success rate and safety: rate of paresthesia, intravascular and dural cannulation.

Key words: Anesthetic techniques; epidural; catheters; paresthesia; side effects.

Introduction

Continuous epidural anesthesia is, besides for analgesia during labor, commonly used for postoperative analgesia. Although considered safe, several complications and problems may occur during epidural puncture and insertion of a catheter (1, 2). Inadvertent dural puncture is reported between 0.04 to 6% and vascular cannulation occurs in 0.7% to 12% (3-5). Further complications are technical difficulties as breakage, kinking, coiling and entrapment during threading or removal of catheter (6-9). However, the most frequently reported complication is paresthesia. Paresthesia usually does not lead to neurological sequelae but is an unpleasant sensation for the patient (10). Reported incidences of paresthesia vary between 0.2 and 56% depending on approach, patient characteristics, technique, and depth of insertion (4, 5, 11, 12). Even an incidence as high as 89% was reported (13).

Considering these high incidences of paresthesia, it would be recommendable, in the development of a new catheter, to determine the incidence of paresthesia in the replaceable catheter as well as in the new one.

To determine the incidence of paresthesia in the use of epidural catheters in two academic hospitals, we prospectively observed in a pilot study the clinical characteristics of two different epidural catheters.

Methods

After approval of the local ethics committee we conducted a prospective, open, non-interventional clinical study on two different epidural catheters to determine the incidence of paraesthesia during catheter insertion. Secondary objectives were: rate of inadvertent vascular cannulation, dural puncture, difficulties with insertion or removal of the catheter and additional complications. Reasons for removal of the epidural catheter were recorded.

In 188 surgical patients, ASA I-III, age 19-87 years, the application of two different epidural catheters in normal clinical practice in UMC
Utrecht and Academic Hospital Maastricht was evaluated. A 20 G polyamide catheter (Perifix® standard, B.Braun Melsungen AG, Germany) was compared with a 20 G combined polyurethane polyamide catheter (Perifix® new, B. Braun Melsungen AG, Germany). The polyamide catheter is currently used as standard catheter in both institutions. The polyurethane polyamide catheter has an outer polyurethane liner and a polyamide body and softens reaching body temperature upon insertion. Therefore a reduced rate of paresthesia is expected. Both catheters are CE-marked. Information regarding the procedure and oral consent of epidural anaesthesia for the surgery was obtained as usual.

Experienced anesthesiologists from both institutions performed all epidural procedures. An independent observer was present during puncture and catheter insertion.

The patients were placed in a sitting position. After sterile preparation and subcutaneous infiltration with lidocaine 1% the epidural space was identified at a level between T6-T12 for thoracic epidural anesthesia (TEA) and at L1-L4 for lumbar epidural anesthesia (LEA) via the midline approach and the loss of resistance to saline technique using an 18 G Perican' epidural needle (B. Braun Melsungen AG, Germany). Upon successful identification of the epidural space the catheter was inserted, at a depth of 4 to 5 cm beyond the needle tip. The patients were as opposed to daily practice not warned that they might feel an electric sensation.

Spontaneous reactions of the patient upon catheter-insertion were recorded. If the patient did not spontaneously report paresthesia, the observer asked explicitly for it.

As paresthesia we considered: pain, electric shock, discomfort, burning sensation, shooting effect, motor reactions, and similar experiences.

Intensity of paraesthesia was scored using a visual analogue scale (VAS) ranging from 0 to 10.

The insertion depth was documented. Fixation of the catheter was done according to standard hospital procedures using a transparent dressing and securing tape and the catheters were aspirated to exclude dural or intravascular positioning. The sensory block was tested 15 minutes after injection of a test dose of lidocaine 2% or bupivacaine 0.5%, both with epinephrine 1:200,000 by cold sensation. Inadvertent dural or intravascular positioning of the catheter was recorded.

The epidural anesthesia was considered successful if a sensory blockade could be measured. If not, an extra injection of 5 ml lidocaine 2% was given and the sensory blockade was re-evaluated. If again no block was achieved the catheter was removed.

Difficulties with catheter-insertion or removal were recorded.

**Statistical analysis**

There are no published data on the frequency of paresthesia with the used catheters. We therefore estimated an incidence of paraesthesia of 40% and assumed a clinically relevant 50% reduction in paresthesia. For a pilot study with a power of 80% and two-tailed error of 5% 80 patients per study phase were appropriate.

Statistical analysis was performed using SPSS for Windows (version 12.0) statistical package (SPSS Inc., Chicago, IL). Patient characteristics were analyzed using the Student t-test for independent groups (age, height, weight) and the \( \chi^2 \) test in a \( \chi^2 \) contingency table (ASA-classification, sex, TEA/LEA). Paresthesia was analyzed using the \( \chi^2 \) test in a \( \chi^2 \) contingency table and logistic regression; VAS was analyzed using Mann -Whitney- U test.

A p value of < 0.05 was considered statistically significant.

**Results**

From both institutions 188 patients were included. The standard catheter was used in 90 patients, the new one in 98 patients. Both groups were comparable regarding demographic data in age, gender, weight and ASA-classification. There was a small but significant difference in height. In the new catheter-group there were more thoracic epidural punctures (Table 1).

The incidence of spontaneous paresthesia was 21.3% with the standard catheter and 16.7% with the new catheter (\( p = 0.42 \)). Using multivariate logistic regression we found an Odds Ratio of 0.75 (95% CI 0.34-1.66). Adjusting for height and thoracic epidural punctures did not influence this. The incidence of paresthesia increased to 37.8% respectively 32.6% when the paraesthesia on questioning was added.

The intensity of paresthesia was scored using VAS (Fig. 1).

There was no significant difference in VAS scores between the catheters.
The mean VAS of patients who reported paresthesia spontaneously was not higher than the VAS of patients who reported paresthesia on questioning (Table 2). The most frequently reported sensation was discomfort (43.1%) followed by pain (32.3%) and electric shock (32.3%), motor reactions (16.9%), shooting effect (9.2%) and other (7.6%). No patient reported a burning sensation. Patients could indicate more than one option. From the patients who reported paresthesia, 35.4% expressed more than 1 sensation.

With the standard catheter in 8 patients (8.9%) there was blood in the catheter after aspiration, which persisted even after 1 cm withdrawal in 2 patients. With the new catheter in only 3 patients (3.2%) inadvertent intravascular cannulation occurred, which persisted after 1 cm withdrawal in 2 patients. In 8 (72.7%) cases in which the catheter was placed intravascular the level of catheter insertion was between T10 and L1 (Fig. 2).

No dural punctures or cannulation occurred.

**Discussion**

This study showed that the new catheter was at least equivalent to the standard catheter in success rate of epidural anesthesia, rate of paresthesia, intravascular cannulation and dural puncture. The incidence of spontaneous paresthesia varied between 16.7 and 21.3% and almost doubled by systematically asking for it. The incidence of intravascular cannulation was 3.2 and 8.9% respectively. This was not significant.

Despite a well functioning acute pain service we report an incidence of treatment failures due to technical problems of 13.3%.

We are aware that the study design is not optimal to compare different epidural catheters.

However as we were not aware of the incidences of paresthesia, rate of inadvertent vascular
cannulation, dural puncture, difficulties with insertion or removal of the used catheter, we decided to evaluate it in a pilot study. The incidences of spontaneous paresthesia and intravascular cannulation were similar as reported in previous studies (11, 14).

We found a surprisingly high overall paresthesia rate. In daily practice we warn patients that they might feel an electrical sensation. The clinical relevance is not very well known, but as patients do report mean VAS scores of almost 4 (on a scale from 0 to 10) the sensation is at least relevant for the patient. Therefore reduction of paresthesia could attribute to improvement of quality of care.

Striking was that with both catheters about 50% of the patients, who experienced paresthesia did not report this spontaneously, but only on questioning. However the intensity of the sensation quantified by VAS was equivalent in both groups. Statistics about paresthesia therefore underestimate the real incidence of paresthesia.

Regarding intravascular cannulation one could speculate about a possible difference due to technical aspect of the catheters. As the new catheter softens with the body temperature the new catheter is less expected to migrate intravascular. However the study was not powered to detect these differences.

The success rate of epidural analgesia is not only determined by successful introduction of catheter. The catheters ought to work as long as analgesia is required. Therefore we have to study the problems leading to early catheter removal.

A lot of articles addressing technical problems with epidural catheters e.g. coiling (9), kinking (15), breakage (6) are case reports.

Our results are consistent with a large audit in 5628 surgical patients (16) where an incidence of 14% technical en 8% treatment failure was observed. However our numbers are too small to make any definitive statements. In the future we need more audits to insure a standard quality of care.

We conclude that the new catheter was at least equivalent to the standard catheter regarding epidural success rate and safety : rate of paresthesia, intravascular and dural cannulation.

Although the clinical relevance of paresthesia during epidural catheter insertion is not known the sensation is relevant to the patients as they report high VAS scores. Reduction of incidence of paresthesia could improve quality of care.

Since patients do not always report paresthesia spontaneously, structured questionnaires are required to avoid the underestimation of the overall incidence of paresthesia.

A difference regarding intravascular cannulation was not shown, due to lack of power of the study.

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Conflict of interest

For the conduct of the study the authors did not receive external financial support.

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