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SCIENTIFIC ARTICLE

A comparison of three different needles used for spinal anesthesia in terms of squamous epithelial cell transport risk☆

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KEYWORDS
Spinal anesthesia;
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Abstract
Background and objectives: To investigate the differences in the number of squamous epithelial cells carried to the spinal canal by three different types of spinal needle tip of the same size.
Methods: Patients were allocated into three groups (Group I, Group II, Group III). Spinal anesthesia was administered to Group I ($n = 50$) using a 25G Quincke needle, to Group II ($n = 50$) using a 25G pencil point spinal needle, and to Group III ($n = 50$) using a non-cutting atraumatic needle with special bending. The first and third drops of cerebral spinal fluid (CSF) samples were taken from each patient and each drop was placed on a slide for cytological examination. Nucleated and non-nucleated squamous epithelial cells on the smear preparations were counted.
Results: There was statistically significant difference between the groups in respect to the number of squamous epithelial cells in the first drop ($p < 0.05$). Group III had lower number of squamous epithelial cells in the first drop compared to that of Group I and Group II. Mean while Group I had higher number of squamous epithelial cells in the third drop compared to the other groups. The number of squamous epithelial cells in the first and third drops was statistically similar in each group respectively ($p > 0.05$ for each group).
Conclusions: In this study of different needle tips, it was seen that with atraumatic needle with special bending a significantly smaller number of cells were transported when compared to the Quincke tip needles, and with pencil point needles.

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PALAVRAS-CHAVE
Raquianestesia;
Líquido cefalorraquidiano;
Agulhas espinhais;
Células epiteliais

Comparação de três agulhas diferentes usadas para raquianestesia em relação ao risco de transporte de células epiteliais escamosas

Resumo
Justificativa e objetivo: Investigar as diferenças no número de células epiteliais escamosas transportadas para o canal medular por três tipos diferentes de pontas de agulhas espinhais do mesmo tamanho.
Métodos: Os pacientes foram alocados em três grupos (Grupo I, Grupo II, Grupo III). Raquianestesia foi administrada aos pacientes do Grupo I (n = 50) com agulha Quincke de 25G, do Grupo II (n = 50) com agulha espinhal ponta de lápis de 25G e do Grupo III (n = 50) com agulha atraumática não cortante de curvatura especial. A primeira e terceira gotas de líquido cefalorraquidiano (LCR) foram colhidas de cada paciente para amostra e cada gota foi colocada em lâmina para exame citológico. As células epiteliais escamosas nucleadas e não nucleadas sobre as lâminas de esfregaço foram contadas.
Resultados: Houve diferença estatisticamente significativa entre os grupos em relação ao número de células epiteliais escamosas na primeira gota ($p < 0,05$). O Grupo III apresentou um número menor de células epiteliais escamosas na primeira gota, em comparação com os grupos I e II, enquanto o Grupo I apresentou um número maior de células epiteliais escamosas na terceira gota, em comparação com os outros grupos. Os números de células epiteliais escamosas na primeira e terceira gotas foram estatisticamente semelhantes em cada grupo, respectivamente ($p > 0,05$, para cada grupo).
Conclusões: Neste estudo de pontas de agulha diferentes, verificamos que com a agulha atraumática de curvatura especial o número de células transportadas foi significativamente menor, em comparação com as agulhas Quincke e ponta de lápis.

Introduction

During spinal anesthesia, the tip of the needle acts as a bistoury and causes epidermal fragments to be implanted into the spinal canal.[1] Epidermoid tumors are extremely rare tumors of the central nervous system.[2] Intraspinal epidermoid tumors are known to develop as a result of the transport of epidermal squamous epithelial cells by trauma, spinal anesthesia, surgery and lumbar puncture.[3–5] Previous studies have shown that the use of smaller diameter needles and allowing a few drops of CSF flow during lumbar puncture reduces the number of transported cells.[6]

In this study, through cytological examination of the first and third drops of cerebrospinal fluid collected during spinal anesthesia, it was investigated if there were any differences in the number of squamous epithelial cells carried to the spinal canal by spinal needles of the same size but with three different tip types (25G atraumatic, 25G pencil tip, 25G Quincke).

Methods

Following the approval of the Ethics Committee, 150 patients undergoing surgery using spinal anesthesia, aged between 18 and 65 years, ASA I-II were divided into three groups of 50 (Group I, Group II, Group III). The study included only the subjects whose first puncture was successful.

Spinal anesthesia was administered using a 25G Quincke needle to the 50 patients in Group I, using a 25G pencil point spinal needle to the 50 patients in Group II and using a (non-cutting) atraumatic needle with special bending to the 50 patients in Group III.

Written informed consent was obtained from all patients. After taking the patients to the operating room, Intravenous (IV) access was established and heart rate, non-invasive arterial blood pressure, and peripheral oxygen saturation (SpO_2) were monitored routinely.

Sedation was administered as Intravenous (IV) 0.05 $mg.kg^{-1}$ midazolam. With the patient in a seated position, the spinal needle was inserted through the L4-5 or L5-S1 interspace and the arrival of cerebrospinal fluid was observed. 0.5% hyperbaric bupivacaine was administered. In all the groups, the first and third drops of CSF samples were taken and each drop was placed onto a separate slide. The CSF samples were smeared to the surface of the slide by touching another slide to the first slide. As a result, two slides were prepared for each drop for cytological examination. The slides were stained with hematoxylin&eosin in the Medical Pathology Laboratory and evaluated under light microscope by a pathologist blinded to the study groups. The total number of nucleated and non-nucleated squamous epithelial cells derived from the layers of epidermis were counted on the whole surface of the two slides of each drop and recorded.

Data analysis was performed using SPSS 21.0 statistical software package. The compliance of data with normal distribution was evaluated with the Kolmogorov–Smirnov test. The Kruskal–Wallis test was used for comparisons between the groups. To determine from which group the difference

Table 1 Comparison of the total number of squamous epithelial cells detected in whole surface of two slides of CSF in groups for drop 1 and 3 (mean ± SD).

	Total number of squamous epithelial cells				*p*	*Z*
	1 Drop		3 Drop			
	Median (Min–Max)	Mean rank	Median (Min–Max)	Mean rank		
Group I	8.5 (0–200)	89.8	10 (0–200)	93.3	0.403	−0.836
Group II	4 (0–59)	77.4	3.5 (0–90)	67.3	0.468	−0.726
Group III	2 (0–43)	59.3	3 (0–37)	65.9	0.193	−1.302

originated, the Tukey HSD test was applied. The values with probability lower than (p) $\alpha = 0.05$ were assumed to be significant.

Results

The patients comprised 51.2% females and 48.8% males with a mean age of 45.53 ± 17.20 years.

A statistically significant difference was determined between the groups in the number of squamous epithelial cells in the first drop ($p < 0.05$). When compared to Group I and Group II, the values of Group III were lower.

A statistically significant difference was determined between the groups in the number of squamous epithelial cells in the third drop. The values of Group I were higher than those of Groups II and III.

No statistically significant difference was determined in any of the groups between the first and third drops, in terms of the number of squamous epithelial cells ($p > 0.05$) (Table 1).

Discussion

Since the time of first manufacture in 1891, the needles used in spinal anesthesia have been produced in different types. With the development of technology, needles are now manufactured with different tips and diameters. Spinal needles in current use have different structures such as Quincke, Whitacre, Sprotte, Atraucan (atraumatic tip) and Spinoject. A pencil point spinal needle is similar to the Whitacre and Sprotte type spinal needles and is available in various sizes such as 22, 25 and 27G. Although the diversity in spinal needles has essentially been made with the intention of reducing post-spinal headache, needle tips are also important with regard to the number of cells transported into the spinal canal during spinal anesthesia application.

Intraspinal epidermoid tumors are quite rare tumors that constitute only 1% of spinal tumors in all age groups. Iatrogenic lumbar intraspinal epidermoid tumors were first identified in 1950 after recurrent antibiotic injections to the subarachnoid space.[7]

Squamous epithelial cells from which the tumor originates can be implanted into the subarachnoid space by trauma, spinal anesthesia, surgery and lumbar puncture.[4–6]

In has been stated in a previous study that the rate of most cell implantation into the spinal canal is 33.3% through epidural needles.[8] Manno et al. reported that in 41% of cases, intraspinal squamous cell tumors are caused by the cells implanted into the intraspinal canal during lumbar puncture.[9]

In another study, it was stated that the rate of tissue transport by spinal needles is around 75% but in CSF, no tissue could be shown.[6] In another study of 4 cadavers, 27G Quincke, Sprotte, and Whitacre needles were compared and it was shown that in CSF, a higher rate of benign squamous epithelial cells were transferred by Quincke type needles.[10] In the current study, evaluation was made of the cerebrospinal fluid of a total of 150 patients to whom spinal anesthesia was administered with 25G Quincke, atraumatic, and pencil point needles. The results showed that in the group where Quincke tip needles were used, the squamous epithelial cell count was significantly higher.

In a study by Taveira et al., using 25G Quincke tip spinal needles, it was shown that of 39 patients, squamous epithelial cells were found in the CSF of 35 patients.[2] In the current study, squamous epithelial cells were present in both the 1st and 3rd drops in all 3 groups. However, although the needle tips were of the same size, in the group where atraumatic needles were used, the number of cells were significantly lower when compared to the other two groups. In the current study, while the number of cells in the group where Quincke needles were used is compatible with the results of Taveira et al., it is very high compared to the atraumatic needle group.

Previous studies in literature have indicated that allowing a few drops of CSF flow with 25G Quincke and Whitacre needles provides washing of tissue fragments.[6] However, in the Taveira et al. study which evaluated the number of cells in the 1st and 3rd drops, no difference was found between the drops. Another publication has also stated that allowing CSF flow of between 8 and 12 drops does not reduce the risk of transportation of epithelial cells.[11] In the current study, there was no statistically significant difference in the number of cells between the first and the third drops, which was consistent with the findings in literature.

In conclusion, the results of this study using different needle tips demonstrated that with atraumatic needles, a significantly smaller number of cells were transported when compared to Quincke tip needles, and with pencil point needles, although not statistically significant, a higher number of cells were carried compared to the group where atraumatic tip needles were used. When selecting the needle tip for use in daily practice, squamous cell transport rate should be a criterion taken into consideration.

Conflicts of interest

The authors declare no conflicts of interest.

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