Ear acupoint detection before and after hysteroscopy: is it possible to clarify the representation of the uterus on the outer ear?

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ABSTRACT

Background In the auricular maps introduced over the past 50 years by the French and Chinese schools, most organs and systems overlap consistently. One exception is the reproductive system, which shows a markedly different somatotopic representation—for example, for the uterus and the ovary.

Objective To identify the distribution of points with increased tenderness to pressure or with reduced electrical resistance, on the outer ear of a group of women undergoing hysteroscopy.

Methods For diagnostic purposes the auricles of 78 women were examined before and after hysteroscopy using a pain–pressure test and electrical skin resistance test. The points identified were transcribed onto a graphic system called Sectogram. Spatial cluster analysis was used to identify the statistically significant clusters of sectors with a higher concentration of points appearing after hysteroscopy.

Results The points identified after hysteroscopy tend to be concentrated in specific areas not previously recognised and which only partially overlap with the French and Chinese representation of the uterus.

Conclusion When auricular acupuncture is applied to reduce discomfort during hysteroscopy, particular attention must be paid when choosing the points/areas to be stimulated, which are not only those indicated in the Chinese or French maps.

INTRODUCTION

Auricular acupuncture, ear acupuncture and auriculo therapy may be regarded as synonymous. They are based on the somatotopic representation of the body on the outer ear, discovered in 1957 by the French doctor Paul Nogier.1

During his efforts to find a reliable and reproducible reflex connection between the outer ear and the body, Nogier carried out a simple experiment with a clamp placed on the tip of the thumb, the subject experiencing a local sensation of pinching. The auricular point representing the thumb became tender when the thumb was painfully compressed by the clamp and reverted to normal afterwards.

During practice every practitioner carries out this procedure of identification with the pressure probe, in order to find the point best corresponding to the painful sensation experienced by the patient. It should be noticed, however, that the intake of some drugs such as benzodiazepines can interfere with the finding of tender points through the pressure probe.2

Another possible diagnostic method is represented by the measurement of electrical skin resistance for individuating the precise location of ear acupuncture points with low resistance. Experimental and clinical evidence shows that these points appear on the surface of the ear during or following major lesions (pain, inflammation, surgery), although the physical basis of these measurements is not completely understood. Usichenko et al5 applied the measurement of electrical skin resistance before, during and after orthopaedic surgery and used the points which were detected more frequently in these patients, in comparison with healthy volunteers, for pain relief after ambulatory knee arthroscopy.

The individuation of the corresponding ailing structure in the body through the topography of the above-mentioned tender and low resistance ear acupuncture points is called auricular diagnosis.

Oleson et al reported a study in which a doctor, blinded to the diagnosis, used tenderness and electrical skin resistance of the ear to correctly identify the affected joint in 40 patients with musculoskeletal pain, with 75% accuracy. Both tenderness and low electrical resistance were significantly more present at corresponding points.5

In a subsequent study Andersson and colleagues6 could not replicate Oleson’s positive results, but their study was limited by small sample size, failure to examine the posterior surface of the ear and arbitrary, non-standard classification of zones.

In another blinded study of 506 patients, Romoli and colleagues, not restricting themselves to musculoskeletal pain disorders, established the diagnostic reliability of three methods: inspection of the outer ear 52%, pain–pressure test (PPT) 34% and electric skin resistance test (ESRT) 33%. If a symptom was associated with a clamp placed on the tip of the thumb, the subject experiencing a local sensation of pinching with a clamp and reverted to normal afterwards.

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Accepted 1 September 2010

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somatotopic representation—for example, for the ovary and the uterus. There is probably a historical reason explaining these differences, because in the first map of 1957 the representation of both organs was ‘forgotten’ by Nogier.

The Chinese authors, therefore, who had truthfully adopted his maps from the beginning, were indeed compelled to find an original location for these organs. In the first maps the uterus was placed in the upper part of the scaphoid fossa, and the ovary on the anterior-medial part of the antitragus. On the current standardised map, which has been accepted in the meanwhile by all Chinese researchers, there is only one location left for the internal genitals, which carries the name of *neishengzhiqi* and is coded TF2 (figure 1). This area holds indications such as irregular menstruation and dysfunctional uterine bleeding.

Also Nogier was compelled to find an original location to represent both the ovary and the uterus which he did, locating in 1977 a gonad point (ovary and testicle) in the internal (hidden) surface of the rising branch of the helix ‘at the junction of the inferior tierce point and the middle tierce point of a line extending from point 0 to the anterior top of the superior concha’.15

In the following years the French school reached an agreement on the representation of the uterus and placed it on the internal face of the ascending branch of the helix, just subjacent to localisation of the kidney (figure 1).

Taking note of this difference in location we tried to give our contribution to the problem of the divergence of representation by examining the auricles of women undergoing hysteroscopy for diagnostic purposes.

Our hypothesis was that the introduction of the hysteroscope into the cervical canal might be sufficiently painful to induce sensitisation and variation of the electrical skin resistance in some recurrent points of the auricle. Therefore, the aim of this study was to determine where the uterus might possibly be represented on the outer ear considering the different representation of the uterus in the French and Chinese auricular maps.

**METHODS**

Seventy-eight consecutive patients (average age 50.8 years, SD 11.5, range 30–79) undergoing hysteroscopy were enrolled. The study was approved by the institutional review board and the patients signed an informed consent form before entering the study.

Each patient's age, clinical and obstetric history and indication for hysteroscopy were recorded. Intervention was made by a gynaecologist not involved in the study who used a rigid hysteroscope with a total diameter of 3.5 mm after having inserted a speculum into the vagina to visualise the cervix. A tenaculum (if required) was applied to the anterior lip of the uterine cervix to facilitate the insertion of the optic. Normal saline was used to distend the uterus and it was instilled from a flexible 500 ml bag wrapped in a pressure cuff connected to a manometer and pumped up to 80–120 mm Hg. To perform the biopsy a flexible curette Novak of 3.5 mm and a Vabra aspirator were used. No premedication such as general/regional anaesthesia or benzodiazepines was routinely administered; this is the usual protocol for hysteroscopy in our clinic. However, in the case of cervical stenosis, para-cervical anaesthesia was used with 10 ml 1% mepivacaine hydrochloride solution injected with a 22-gauge spinal needle at four sites (at 3, 5, 7 and 9 o’clock positions) at the junction of the cervix and vagina.

Two authors (DB and BDR, both gynaecologists and experienced acupuncturists) performed auricular diagnosis. In this study we used the diagnostic methods PPT and ESRT cited above: in the first method the tender points of the ear were located with a metal-tip spring probe at the same threshold of 250 g pressure; in the second, the spots with lower electrical skin resistance were detected with the electronic device Agiscop (Sedatelec, Irigny, France). This device measures discontinuities of skin resistance varying from 300 kΩ to 20 MΩ and has a probe comprising two concentric electrodes. We maintained constantly the same threshold throughout the whole diagnostic procedure choosing position 4 of the ‘sensitiveness knob’, which corresponds to a difference in resistance of about 1 MΩ between the centre and the coaxial electrode. For the correct transcription of points detected we used the ‘sectogram’.14 This is a graphic system which has been validated for the statistical appraisal of the distribution per sector of the points at different times of a clinical trial (figures 2 and 3).

Immediately before each hysteroscopy, the acupuncturist DB tested the whole anterior and posterior surfaces of the outer ear of the patient proceeding from the upper to the lower part. On the anterior surface the auricular areas tested were in order: the triangular fossa, the scaphoid fossa, the superior concha, the inferior concha, the helix, the antihelix, the tragus and the antitragus.

The acupuncturist used first the ESRT method, then the PPT method, in order to avoid the possibility that pressure on the skin could elicit a false-positive response in the following ESRT. The points characterised by reduced electrical skin resistance or greater tenderness were marked with a felt-tip pen on the ear. The auricular diagnosis lasted for about 2–3 min for each of the two methods. The localisation of all detected points was immediately transcribed by DB onto two sectograms (one for each method) that were subsequently sealed in an envelope and

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**Figure 1** Representation of the female genital system according to the
Chinese standardisation of ear acupuncture areas (TF2 and HX4) (in blue,
on the lateral surface); the representation of the female genital system
according to the French school (F) (in orange): the external genitals are
represented on the lateral surface of the lower part of the helix, and the
vagina and the uterus are represented by dotted lines on the internal
(hidden) border of the helix.

stored with the medical records of the patient. Immediately after hysteroscopy, the second acupuncturist BDR (not previously present) performed another similar auricular diagnosis and the sectograms obtained were stored in the same manner. The first examiner was not present when the second examiner tested the ears.

Immediately after, each patient was asked by another operator (ICG), who was not directly involved with the procedures, to rate the intensity of pain experienced during hysteroscopy according to a verbal Numeric Rating Scale (NRS) scoring from 0 (absence of pain) to 10 (worst imaginable pain).

At the end of the study all the envelopes with the sectograms and results of NRS were given to our statistician who independently entered them onto an electronic database and performed a statistical analysis on the basis of the following conjectures:

1. the number of points detected with PPT and ESRT after hysteroscopy is associated with NRS scoring;
2. the average number of points detected both with PPT and ESRT increases after hysteroscopy;
3. the new points identified after hysteroscopy have a specific distribution and concentrate themselves significantly in some sectors of the sectogram.

To perform our analysis we used the following statistical methods:

1. correlation coefficient between NRS scoring and the number of points detected with PPT and ESRT after hysteroscopy. A t test was then used to evaluate the significance of the correlation coefficient;
2. paired t test comparing the average number of points detected by PPT and ESRT before and after hysteroscopy. We tested the null hypothesis of no variation in the average number of points after hysteroscopy against the alternative hypothesis of an increase of the average number of points;
3. ‘spatial cluster analysis’ adopting the algorithm proposed recently by Aldstadt and Getis, called AMOEBA (A Multidirectional Optimal Ecotope-Based Algorithm).15 AMOEBA, which has been applied mainly in epidemiological studies, may be used also as a clustering procedure in the presence of spatial constraints. In our case the constraint is represented by the contiguity of the ear sectors. The authors suggest using the Getis G* index to perform the zoning (a zone is the result of sector aggregations). In our case, the index G* has an approximately standardised normal distribution and zones are formed for significant values of the G* index. Two or more sectors are aggregated if the G* index increases its value and the aggregation is stopped if G* decreases. This is the reason why a p value is associated with each aggregation of sectors and the method may appear to be a parametric method.

**RESULTS**

Of the 78 patients examined, 42 (53.8%) were premenopausal and 36 (46.2%) postmenopausal. The indications for hysteroscopy are reported in table 1. Forty-eight (61.5%) of 78 patients underwent endometrial biopsy.

For pain during hysteroscopy we found an average NRS scoring of 5.7 (SD 2.6) in the whole group. We observed a slightly higher, but not significant, level of NRS in patients undergoing biopsy (6.1, SD 2.3) than in the others (5.1, SD 2.5). In eight cases with cervical stenosis, who received paracervical anaesthesia, the average scoring of NRS was 5.5 (SD 2.2) compared with 5.7 (SD 2.8) for the non-anaesthetised subgroup: even in this case the difference was not statistically significant.

To evaluate the association between the increase of points after hysteroscopy and NRS scoring we calculated the correlation coefficient obtaining in the total group of sectors (1–40). A significant value for PPT and for ESRT was obtained (table 2).

Both diagnostic methods showed a significant increase in the total number of points identified before and after hysteroscopy: 25.2% and 9.0%, respectively (table 3).

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**Table 1 Indications for hysteroscopy in 78 patients**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected intrauterine outgrowth (endometrial polyps, submucosal myomas)</td>
<td>33</td>
</tr>
<tr>
<td>Abnormal uterine bleeding</td>
<td>19</td>
</tr>
<tr>
<td>Endometrial hyperplasia</td>
<td>8</td>
</tr>
<tr>
<td>Tamoxifen treatment</td>
<td>6</td>
</tr>
<tr>
<td>Cervical polyps</td>
<td>5</td>
</tr>
<tr>
<td>Infertility/sterility</td>
<td>4</td>
</tr>
<tr>
<td>Lost intrauterine device</td>
<td>2</td>
</tr>
<tr>
<td>Staging of endometrial carcinoma</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>78</strong></td>
</tr>
</tbody>
</table>
A paired t test showed a significant difference in the average number of points detected before and after hysteroscopy with PPT and ESRT, respectively p<0.0005 and p<0.05 (table 4).

We applied AMOeba cited above, which identified a significantly higher number of new points (figures 2 and 3), compared with the average per sector, in sector 24 for PPT and sectors 23, 24 and 25 for ESRT (table 5).

**DISCUSSION**

Our initial hypothesis was that the introduction of the hysteroscope into the cervical canal might be painful enough to induce a sensitisation and/or a variation of electrical skin resistance in some specific auricular areas in the few minutes following. Several authors confirm that hysteroscopy, despite its short duration and the recent improvement of techniques and materials, still causes a non-negligible amount of pain which continues to be the most common cause of its failure, even when local anaesthesia is used.16–18 The average of pain experienced by our patients was indeed 5.7 and only 5.5 in those receiving paracervical anaesthesia. It appears possible, therefore, according to the basic experiment of Nogier, that a painful peripheral stimulation may temporarily activate a specific point of the outer ear in the single subject. In a sufficiently large number of patients as in our study, the distribution of points tends to be concentrated in specific areas of variable dimensions.

Our study demonstrated that sectors 23, 24 and 25 of the outer ear are sectors in which the number of points appearing, elicited by hysteroscopy, is significantly higher than the average of points per sector.

In our opinion, this study could help the acupuncturist to identify a more precise representation of the uterus on the outer ear. The auricular zones which showed an increased tenderness or a reduced electrical resistance overlap indeed only partially with the proposed somatotopic areas of the uterus according to the French and Chinese schools. For example sector 24, the most important since it was identified by both diagnostic methods, showed a high concentration of points on the helix where neither the French nor the Chinese school represent any part of the genital system. The same occurred with sector 23, even if a smaller percentage of points was found in the triangular fossa, both on sectors 23 and 24, where the Chinese school represents the internal genitals (figure 1). For sector 25, we may consider the overlapping on the helix with the representation of Chinese external genitals and an overlapping with the French representation of the uterus located, however, on the internal part of the helix.

This is an innovative and preliminary study and has some limitations.

First of all, we did not perform a third evaluation, registering ESRT and PPT, for example, after 30 or 60 min, to record the eventual disappearance of sensitisation/points in the observed areas. Moreover, in our protocol the two acupuncturists, DB and BDR, always performed the auricular diagnosis respectively before (DB) and after (BDR) hysteroscopy. Thus, the differences in the sensitisation or the variation of electrical resistance that we found might also be partially due to interobserver variations. Unfortunately, this study was not intended to test interobserver reliability, since our main aim was to provide clinical evidence for possible practical application of the method. However, in
future studies each observer could be randomly allocated to pre- and post-observations in order to eliminate this bias.

Another limitation might be that, acupuncturists involved in auricular diagnosis knew the Chinese and French representation of the uterus. One could object that this might affect their observation, as changes might be expected to be more likely in certain locations. However, in our study we tested the whole anterior and posterior surfaces of the outer ear, independently of the Chinese and French maps. Moreover, the aim of our study was to identify the auricular zones corresponding to the anatomical parts involved in hysteroscopy and endometrial biopsy, regardless of the Chinese and French representations of the female genital system.

Thus, how could the information gathered in this study be put into practice?

It is possible that auricular stimulation of the identified specific areas could be used, first of all, for reducing discomfort during hysteroscopy. Another possible application might be for inducing or enhancing cervical dilation during labour. In both cases there is an urgent need for a pilot study to demonstrate which type of stimulation (needles, Vaccaria seeds, magnetic pellets, electric stimulation, etc) and what frequency and timing of sessions would be most promising in obtaining the desired effect.

Competing interests None.

Ethics approval This study was conducted with the approval of the institutional review board of the Department of Gynecology and Obstetrics, University of Turin, Turin, Italy.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES


Table 4  t Test for the difference in the average number of points detected with PPT and ESRT before and after hysteroscopy

<table>
<thead>
<tr>
<th></th>
<th>PPT</th>
<th>ESRT</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference in the average number of points</td>
<td>SD</td>
<td>t</td>
<td>df</td>
<td>p Value</td>
<td>Difference in the average number of points</td>
<td>SD</td>
</tr>
<tr>
<td>1.5</td>
<td>0.40</td>
<td>3.75</td>
<td>77</td>
<td>&lt;0.0005</td>
<td>1.06</td>
<td>0.57</td>
<td>1.88</td>
</tr>
</tbody>
</table>

ESRT, electrical skin resistance test; PPT, pain–pressure test.

Table 5  Sectors in which the number of new points after hysteroscopy was significantly higher than the average of points per sector, according to the Getis–Ord local statistic Gi*

<table>
<thead>
<tr>
<th></th>
<th>PPT</th>
<th>ESRT</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectors; R and L</td>
<td>Gi*</td>
<td>p Value</td>
<td>Sectors; R and L</td>
<td>Gi*</td>
<td>p Value</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>4.73</td>
<td>&lt;0.001</td>
<td>23, 24, 25</td>
<td>5.12</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

ESRT, electrical skin resistance test; PPT, pain–pressure test.

Summary points

- The reproductive organs are represented on the ear in different sites according to French and Chinese maps.
- We examined the ears of 78 women before and after hysteroscopy.
- We found some overlap with both maps but also new areas not previously described.
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Acupunct Med published online October 5, 2010

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