

Perineal pain and inferior cluneal nerves: anatomy and surgery

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Abstract Neuropathic perineal pains are generally linked to suffering of the pudendal nerve. But some patients present pains described as a type of burning sensation located more laterally on the anal margin and on areas including the scrotum or the labiae majorae, the caudal and medial parts of the buttock and the upper part of the thigh. These pains extend beyond the territory of the pudendal nerve. It is interesting to note that the inferior cluneal nerves are responsible for the cutaneous sensitivity in the inferior part of the buttock. We wanted to check if these nerves, or some of their branches, could be responsible for such pains. An anatomic study, containing six dissections on corpse, has been conducted. The inferior cluneal nerves, emerging from the posterior femoral cutaneous nerve have some branches joining the perineum, especially by a perineal ramus. However, two conflict areas have been identified on the path of these nerves and on the perineal ramus: one at the level of the sacrotuberous ligament, and the other being the passage under the ischium. Two surgical approaches have been established from these observations with the aim of suppressing the conflicts.

Keywords Perineal pain · Inferior cluneal nerves · Anatomy · Surgery · Pudendal nerve

Introduction

Neuropathic perineal pains are generally caused by a conflict on the path of the pudendal nerve [10]. These are positional pains, which increase in the sitting position. However, some patients complain about pain, as a type of burning, in areas including the scrotum or the labiae majorae, the lateral part of the anal margin, the caudal part of the buttock, and the proximal and dorsal parts of the thigh [7]. Inferior cluneal nerves are traditionally responsible for the sensitive cutaneous innervation of the caudal part of the buttock. Our work consisted of the anatomic study, by dissection of these nerves, in order to determine the sensitive innervation area, with the aim of doing CT-guided anaesthetic infiltrations on the potential conflict areas, and determining a surgical approach such as the pudendal approach we previously described [12].

Materials and methods

We carried out six dissections on corpses at the anatomy laboratory in the medical faculty in Nantes. Most of these dissections were done bilaterally, with the help of enlarging spectacles, on anatomic pieces including pelvis and thighs, kept in a formol solution, belonging to an 83-year-old female subject, to an 86-year-old male subject, and to a 91-year-old female subject.

Methods

We applied the same protocol for our first three dissections. After a vertical incision passing by the greater trochanter, and a transversal incision 3 cm under the iliac crests, we folded back the shred, dissected and severed the gluteus

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maximus, in order to uncover ventrally the sciatic nerve and the posterior femoral cutaneous nerve. This nerve ramifies into the inferior cluneal nerves and the perineal ramus passing through the gluteus maximus fascia. We located the cutaneous level of the passage, in order to continue the dissection on the caudal and dorsal parts of the muscle. Then, we followed the nerves to their ending in order to identify their exact sensitive territory. Finally, we located the level of the passage of the perineal ramus for a possible surgical approach (cf. infra).

The next dissection was carried out layer by layer. After removing the skin covering the caudal part of the buttock and the cranial and dorsal parts of the thigh, we located the exit of the different sensitive nerves through the fascia of the gluteus maximus and of the hamstring muscles. Then we dissected these nerves through the fascia to reach their origin and identify them.

Finally, on the last anatomic piece, using the informations from our previous dissections, we carried out different surgical approaches, which enabled us to reach the inferior cluneal nerves, the perineal ramus and the posterior cutaneous femoral nerve at the different conflict levels. The first approach was a transgluteal incision, two finger-widths above the ischiatic tuberosity, which let us reach the sacrotuberous ligament, and the posterior femoral cutaneous nerve accompanied by the inferior gluteal vessels laterally. The second approach, which was carried on the lateral part of the ischium did not let us to reach our objectives and was therefore abandoned. Finally, the third approach, at two finger-widths under the ischiatic tuberosity, allowed us to reach the perineal ramus. We checked this procedure on both sides of this anatomic piece and on the first one.

Results

Anatomic description

Origin

The inferior cluneal nerves stem from the posterior femoral cutaneous nerve, a few centimeters from its origin. The posterior femoral cutaneous nerve is composed of fibers coming from the ventral branches of S1, S2 and S3 spinal nerves (Fig. 1), and is located inside and behind the sciatic nerve. On our dissections, we observed that the inferior cluneal nerves stemmed from the medial and lateral edges of the posterior femoral cutaneous nerve (Fig. 2). We also found some very proximal branches stemming from the sensitive roots, even before the posterior femoral cutaneous nerve formation. The most distal branches stemmed from this nerve at the level of the inferior edge of the ischium.

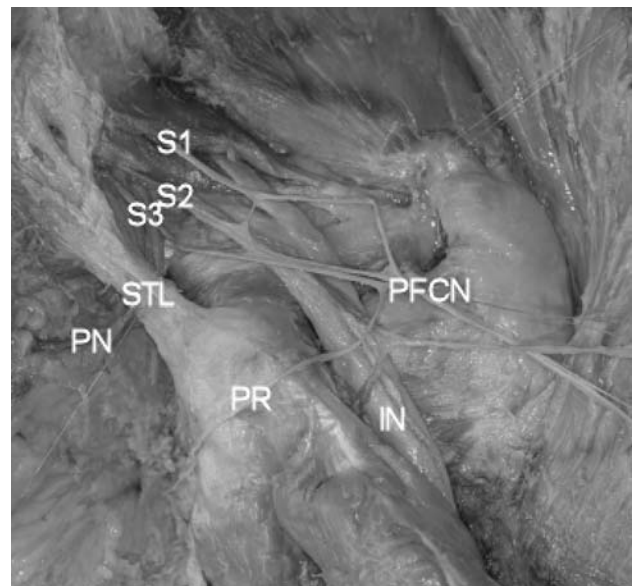


Fig. 1 Dorsal view of the gluteal area. *STL* Sacrotuberous ligament; *IN* ischiatic nerve; *PN* pudendal nerve; *S1*, *S2*, *S3* sciatic roots S1 S2 S3 of the posterior femoral cutaneous nerve; *PFCN* posterior femoral cutaneous nerve, dissected and lateralized; *PR* perineal ramus

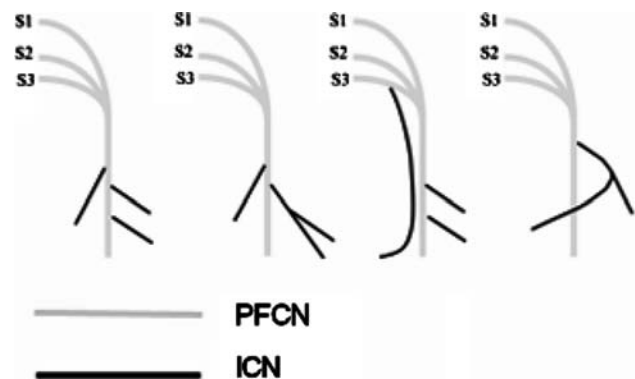


Fig. 2 Variations of the born of the inferior cluneal nerves on the posterior femoral cutaneous nerve, right, posterior view of the gluteal area. *PFCN* Posterior femoral cutaneous nerve, *ICN* inferior cluneal nerves

The course

The number and course of the inferior cluneal nerves not only varied from one individual to another but also from one side to the other.

Generally, we found two or three principal branches. The branches stemming from the lateral edge of the posterior cutaneous nerve (two on average) continued on downwards, along the posterior femoral cutaneous nerve and the inferior gluteal vessels, in a vasculo-nervous pedicle located in a lubricating slip area. They then separated gradually from this pedicle in order to reach the caudal edge of the gluteus maximus, which they circumvented to join the dorsal face of this muscle. This circumvention was done at

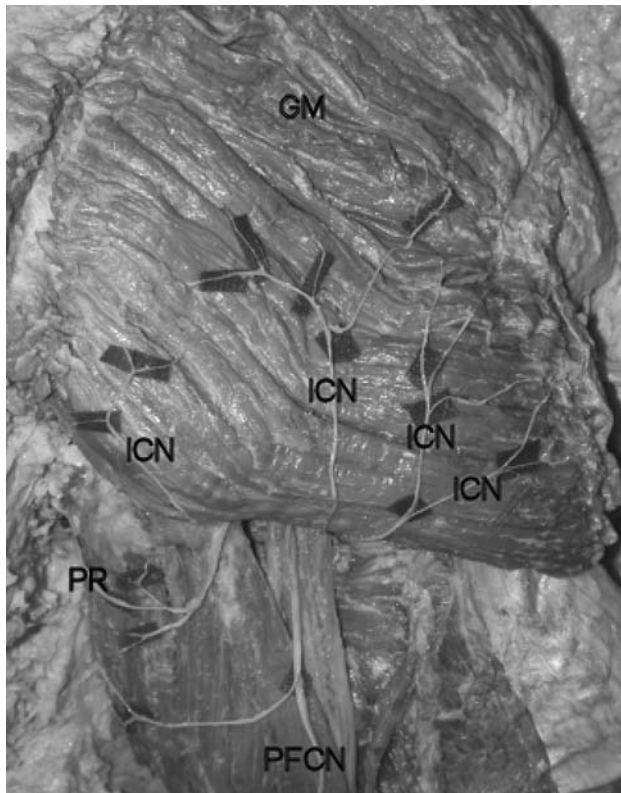


Fig. 3 Posterior view of the gluteal area. *GM* Gluteus maximus dissected and placed in anatomic position; *PFCN* posterior femoral cutaneous nerve; *ICN* inferior cluneal nerves; *PR* perineal ramus

variable levels at the caudal edge of the gluteus maximus (Fig. 3).

At this point, the inferior cluneal nerves perforated the gluteus maximus fascia and continued to spread out inside

it. The different inferior cluneal nerves, distributed on the back of the gluteus maximus, reached the skin of the inferior gluteal area, perforating the fascia (Fig. 4). Then they divided into smaller branches, innervating the whole cutaneous area.

Strictly speaking, the branch stemming from the medial edge of the posterior cutaneous nerve divided into two kinds of nerves: inferior cluneal nerves and a perineal ramus reaching the pudendal nerve area. After a short course in the vasculo-nervous pedicle, this common trunk went into the corner formed by the gluteus maximus cranially and the insertion of the hamstring muscles on the ischium medially. The perineal branch had a horizontal course, following the inferior edge of the ischiatic tuberosity and reaching the perineum. In this horizontal part, this nerve was located in a fatty and fibrous slip area. Proximally, the cluneal nerves emerging from a common trunk could have a recurrent course on the dorsal face of the gluteus maximus, near the ischium. More distally, the perineal ramus divided into branches leading to the lateral part of the anal margin and to the labia majora, or the scrotum.

Relations with particular structures

At a very proximal level, the roots of the posterior femoral cutaneous nerve, or inferior cluneal nerves stemming from S3 directly, went into a corridor limited by the piriformis cranially and dorsally, by the gluteus maximus dorsally, by the internal obturator accompanied by the gemellous muscles caudally and ventrally. The sacrospinatus ligament, the sciatic spine and the pudendal nerve were connected medially.

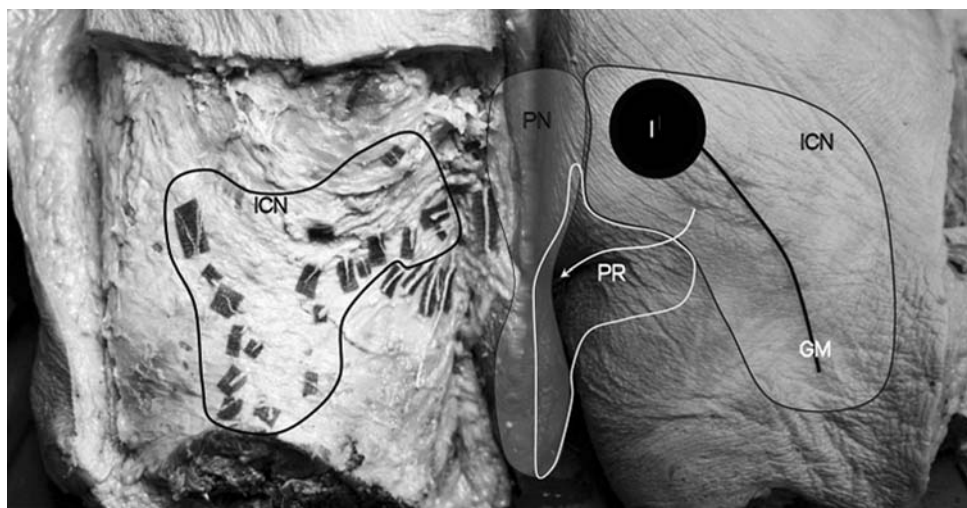


Fig. 4 Picture assemblage from two dissections; on the *left*—posterior view of a left gluteal area, dissection with conservation of the fascias of the gluteus maximus and the hamstring muscles; on the *right*: posterior view of the right gluteal area; *I* ischium, *GM* inferior edge of the gluteus maximus, *ICN*: on the *left*—perimeter of exit of the inferior

cluneal nerves through the gluteus maximus fascia, on the *right*—territory innervated by the inferior cluneal nerves; *PN*: territory innervated by the pudendal nerve; *PR*: perineal ramus, territory innervated by this nerve

In their initial way, the inferior cluneal nerves were in a pedicle containing the posterior femoral cutaneous nerve and the inferior gluteal vessels. On the medial edge were the ischium and the sacrotuberal ligament, on the ventral edge the sciatic nerve and on the dorsal edge, the gluteus maximus. When the inferior cluneal nerves separated from the posterior femoral cutaneous nerve, they were in relation with the inferior gluteal vessels that accompanied them to the caudal edge of the gluteus maximus. At this point, the vessels penetrated the muscles to vascularize it, whereas the nerves circumvented it in order to reach the gluteal skin. Strictly speaking, the medial inferior cluneal branch, common to inferior cluneal nerves and to the perineal ramus, was in close relation with the sacrotuberal ligament and the ischium medially. In its horizontal course, the perineal ramus moved along alone in its fatty and fibrous corridor, under the ischium and behind the hamstring muscles.

Cutaneous anatomic marks

Due to the fat of the gluteal area, marks and cutaneous projections have been hard to highlight [1]. The ischium was the principal palpated element. The perineal ramus had a course of less than two finger-widths under this relief. Between the ischium and the greater trochanter, we were able to palpate the inferior edge of the gluteus maximus, where the inferior cluneal nerves circumvented the muscle at different points. This palpation is easily carried out on a muscular patient or on a thin patient.

The cutaneous territory innervated by the inferior cluneal nerves and their branches (perineal ramus) corresponded to the inferior and medial parts of the buttock, the proximal and posterior part of the thigh, the lateral part of the anal margin, and the scrotum or labia majora.

Conflict areas

We have identified two possible conflict areas on the inferior cluneal nerve course. The first one would extend from the passage of the perineal ramus under the ischium to the perineum. It would be an under-and-into-ischiatric conflict. At this point, the nerve was located in a more or less fatty and fibrous slip area. If there were a removal of the perineal fat, a mechanical fibrosis of slip areas or a traumatic perineural fibrosis (a fall on the ischium followed by a haematoma), it would cause perineal ramus lesions. These lesions would be due to nerve compression by the ischium on the hamstring muscles in a sitting position, and stretchings of the perineal ramus in internal rotation of the thigh. The second conflict zone would be proximal, at the level of the sciatic spine and the piriformis. At this point, the roots of the posterior femoral cutaneous nerve, from which stems the inferior cluneal nerve, could be encircled by the piriformis

against the sciatic spine. Such a conflict could create a lesional association affecting the posterior femoral cutaneous nerve, the inferior cluneal nerves and also the pudendal nerve, owing to its relation with the piriformis and the sciatic spine.

Two unusual kinds of conflict have therefore been identified at the stem of the inferior cluneal nerves. On the one hand, in the vasculo-nervous pedicle located in the front of the gluteus maximus, the inferior gluteal vessels could compress the nerve via some anastomoses passing in front of and behind the nerves. On the other hand, the most medial branch of the inferior cluneal nerves could stem directly from the ventral branch of the S3 spinal nerve and go through the sacrotuberal ligament. There was also a real ligament pinch that could trigger a nerve entrapment, responsible for pain. These kinds of conflicts have been already described on the pudendal nerve course [12] (Fig. 5).

Whatever the cause, it is the sitting position that triggers the conflicts, giving this clunealgia syndrome the same semiologic appearance as the one described in pudendalgia syndrome.

Surgical approaches

The surgical approach on inferior cluneal nerves had to take into account several constraints. The first one was to find

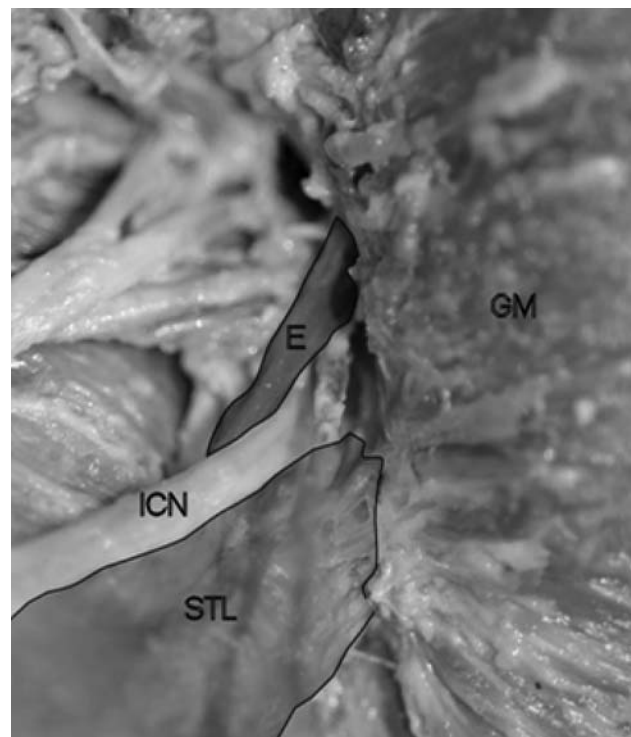


Fig. 5 Posterior view of the left gluteal area: *GM* gluteus maximus, posterior view of the medial part; *ICN* inferior cluneal nerve from S3; *STL* sacrotuberal ligament; *E* STL expansion

systematically those nerves that had lots of variations and that were located in a fatty area. The second one was to reach the different conflict areas even if they were at different points. Then, the surgery had to avoid the support zone of the ischium in order to facilitate the post-operative healing.

The easiest access to the first described conflict area was carried out on the cranial and posterior parts of the thigh, on a leg placed in external rotation in order to put the hamstring muscles as medially as possible. A 5-cm-long arciform incision, made at two finger-widths under the ischium (Fig. 6) enabled us to locate the perineal ramus by dissecting the underlying fat and in going back up progressively to the inferior edge of the ischium (Fig. 7). When the nerve was located, we could follow it in its fibrous and fatty corridor to the perineum. The exploration could be also more lateral in order to find the passage of the nerve in the corner formed by the gluteus maximus proximally and the hamstring muscles medially (Fig. 8).

The second conflict area associated a pudendalgia and a clunealgia in the cranial zone. The piriformis syndrome could be the cause. The surgical technique was identical to the one used in an isolated pudendalgia [11–13].

The chosen surgical approach would depend on CT-guided anaesthetic infiltrations results (cf. infra).

Discussion

Anatomic discussion

The inferior cluneal nerves have a remarkable course submitted to lots of variations.



Fig. 6 Posterior view of the right gluteal area: incision at two finger-widths under the ischium

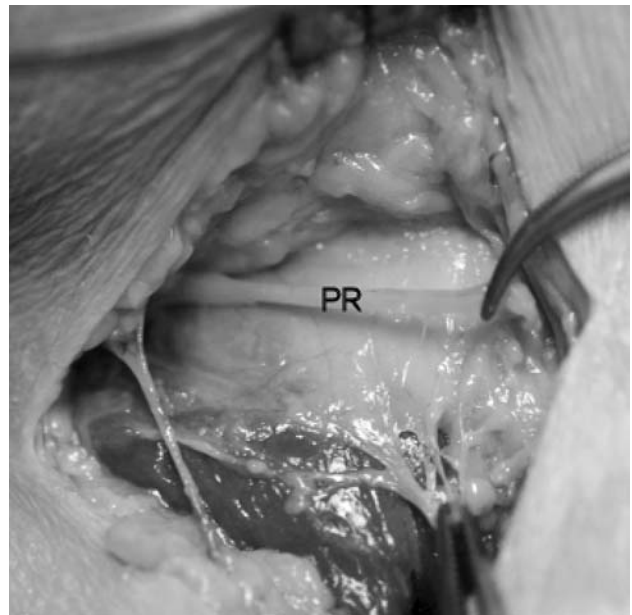


Fig. 7 Posterior view of the right gluteal area: perineal ramus (PR) spot in the fat under the ischium

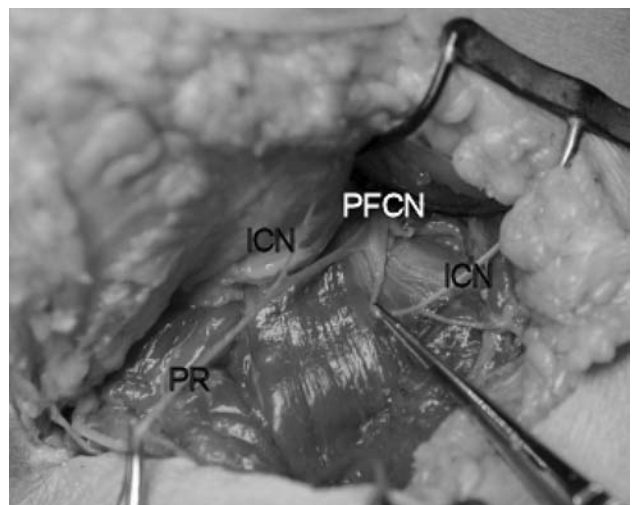


Fig. 8 Posterior view of the right gluteal area: we dissected the perineal ramus (PR) laterally in order to find the inferior cluneal nerves (ICN) and the posterior femoral cutaneous nerve (PFCN)

In the literature, bibliographic resources about the inferior cluneal nerves and their branches are rare and are found only in classic anatomic resources [3–5, 8, 9, 15–17].

All the authors describe the origin of the inferior cluneal nerves, called also gluteal branches [3] or buttock cutaneous ramus [3, 16], at the posterior femoral cutaneous nerve. According to the resources, their numbers are variable. Generally, their course consists two phases: first the nerves go to the inferior edge of the gluteus maximus in front of it, and then they circumvent it and have a recurrent course behind the muscle to reach their innervation territory. We found one description of inferior cluneal nerves going

through the gluteus maximus. Strictly speaking, the common trunk to inferior cluneal nerves and the perineal ramus have not yet been described.

The perineal ramus, which was assigned to Soemmering [4, 9] is described in several ways. Some authors have noticed a unique perineal ramus emerging from the posterior femoral cutaneous nerve. Others have described two ramii. One author has written about a one-sided specificity [4]: the left posterior cutaneous nerve would be the origin of a unique perineal ramus, whereas the right one would be the origin of two ramii.

In our dissections, the inferior cluneal nerves stemmed from the posterior femoral cutaneous nerve, had a course in a vasculo-nervous pedicle (cf. supra), reached the caudal edge of the gluteus maximus, then circumvented it at variable levels (but never went through it), to have a recurrent course at its dorsal side. The perineal ramus, which always stemmed from a common trunk, reached the perineum via an infra-and-into ischiatic path, and innervated the scrotum or the labia majora and the lateral part of the anal margin.

The differences in our observations have to be considered in relation to the number of our dissections.

Clinical discussion

Anatomical observations have enabled us to clarify the semiology of the clunealgia syndrome. This syndrome is characterized by pains, as a type of burning sensation, intensified by the sitting position, concerning the caudal and medial part of the buttock, the dorsal and proximal parts of the thigh, the lateral part of the anal margin, the skin of the big labias and the scrotum (Fig. 4). The level of the conflict can be found clinically. When the pain concerns only the lateral part of the anal margin and the scrotum or the labia majora, or radiates to the medial part of the buttock and the cranial and dorsal parts of the thigh, we can evoke an into-and-under ischiatic conflict concerning the perineal ramus or the common trunk to this ramus and stricto sensu inferior cluneal nerves. These pains are caused by the sitting position on a *hard* seat, increasing the compression of the nerves against the ischium and the hamstring muscles. This diagnosis must be differentiated from a pudendalgia that concerns only the perineum (anus, penis, clitoris) and that is caused by the sitting position on a *soft* seat or a bicycle seat, increasing the compression of the soft parts of the perineum, and enforcing the conflict at the level of Al Cock's canal and of the sciatic spine [2, 6, 10, 12].

Some patients complain about pains on a bigger territory containing the whole perineum and radiating to the buttock and the dorsal and cranial parts of the thigh and sometimes to the whole dorsal part of the thigh. We are also confronted by a lesional association on the pudendal nerve, inferior cluneal nerves, and posterior femoral cutaneous

nerve territories. We have to evoke a proximal conflict at the level of the piriformis and the sciatic spine probably caused by a piriformis syndrome.

When a patient is suffering from clunealgia, we have to work out a precise therapeutic strategy. After the diagnosis, defined by accurate semiologic points, we can confirm the conflict localisation by CT-guided infiltrations at different levels of 40 mg anaesthetic products (3 cc lidocaine 1%, 1 cc methylprednisolone).

If it is an isolated clunealgia (presumed conflict under the ischiatic tuberosity), we injected the anaesthetic products under the gluteus maximus and on the lateral edge of the hamstring muscles insertions (Fig. 9), that is to say, at the level of the passage of the perineal ramus or of the common trunk (1 cm laterally from the caudal edge of the ischium).

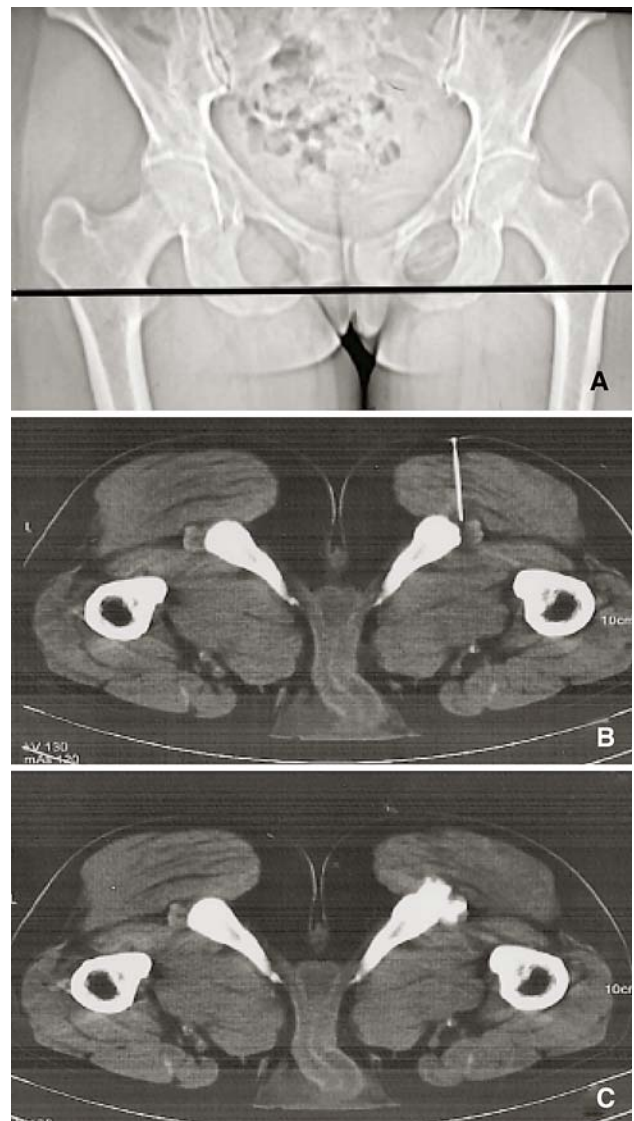


Fig. 9 CT-guided infiltrations of the right inferior cluneal nerves: **a** level of the infiltration; **b, c** infiltration through the gluteus maximus, on the lateral and inferior edges of the ischium

The quantity of injected products is insufficient to cause anaesthesia, but is enough to stop the pains. Furthermore, the infiltration at this level avoids a diffusion of the product to the pudendal nerve, which then avoids confusion in diagnosis.

If it is a semiologic diagnosis of lesional association concerning the pudendal nerve, the inferior cluneal nerve and the posterior femoral cutaneous nerve (presumed conflict at the level of the sciatic spine), the infiltration is carried out through the gluteus maximus, at the level of the sciatic spine. The protocol is the same as the one used in the case of pudendalgia [6, 12].

After the infiltrations, in case of improvement or temporary pain disappearance, surgery is considered. In case of isolated clunialgia with an under-and-into ischiatic conflict, the approach is that described previously (cf. surgical approach) on the dorsal and cranial parts of the thigh. However, due to the fatty tissue of this area, this surgical approach is quite awkward and therefore requires a lot of preliminary practice on corpses. We will publish later the results of our clinical serial (six operated patients today).

A transgluteal approach is realized when a clunealgia is associated to a pudendalgia, for instance, a piriformis syndrome. This technique has already been tested in treatment relating to the pudendal nerve, in which the surgery had been validated by a randomized prospective study [14]. However, among the operated patients, two-thirds of them have greatly improved, but some patients still have pains, in particular on the inferior cluneal nerve territory. In this case, the first approach is advocated.

Conclusion

The inferior cluneal nerves, stemming from the posterior femoral cutaneous nerve, innervated the inferior gluteal area skin and a part of the perineum with a perineal ramus.

Some compressions of the nerves, in particular at the level of the passage in the corner formed by the gluteus maximus and the hamstring muscles insertions, the passage of the perineal ramus under the ischium in a fibrous and fatty corridor, can be the cause of pains on the sensitive territory. Furthermore, there are some perineal pains on the pudendal nerve and inferior cluneal nerve territories: we have to conclude that a conflict on the piriformis duct is the cause of these pains. Infiltrations of these nerves at the level of identified conflict areas must be carried out on patients complaining about typical pains in order to confirm the implication of the inferior cluneal nerves and of their perineal ramus. If the pains are temporarily suppressed by the infiltrations, a surgery is suggested.

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