Uncommon course of obturator nerve through an osseous tunnel: Clinical relevance

Introduction
The obturator nerve arises from the ventral branches of the 2nd, 3rd, 4th lumbar ventral rami. The rami fuse forming the obturator nerve in the substance of the psoas muscle, emerge from the medial aspect of the psoas major at the pelvic brim then it descends forwards along the lesser pelvic lateral wall (iliopectineal line) anteromedial to the obturator internus to enter the obturator foramen. The obturator nerve and vessels leave the lesser pelvis as they enter the obturator canal, an opening below the superior pubic ramus in the superior part of the obturator membrane that spans the obturator foramen. The obturator nerve leaves the obturator canal to enter the medial thigh where it divides into anterior and posterior branches supplying the adductor muscles and skin of that region. Anatomical variations of the lumbar plexus or its individual nerves and its clinical importance have been reported [1]. However, to the best of our knowledge, this is the first report on the uncommon course of obturator nerve through an independent osseous tunnel. Its clinical relevance in surgery or trauma related to pelvic bone will be discussed.

Case Report
A unilateral dissimilarity in the course of the left obturator nerve was observed while exposing the components of the pelvis and lumbar plexus during cadaveric dissection. The donor was a 94-year-old Caucasian male died of renal and respiratory failure. Typically, obturator nerve arose from the ventral rami of lumbar spinal segments of 2–4 and traveled forwards along the lesser pelvic lateral wall (iliopectineal line) anteromedial to the obturator internus to enter the obturator foramen. In the present case, the variant obturator nerve descended normally anterior to sacroiliac junction, continued the lateral pelvic course and entered a 6 cm long osseous tunnel (Figures 1a, 2) beginning at the iliopsoas muscle (close to ischial spine) and emerged to continue a normal course accompanied by the obturator vessels at the typical pelvic aspect of the obturator canal. As seen in Figure 2 the uncommon osseous tunnel was present primarily in the superior pubic rami. The obturator nerve and vessels then continued through the obturator canal in a usual manner. The right side of the pelvis exhibited features consistent with the usual course for the obturator nerve (Figure 1b.) The lumbar plexus and its other branches on both sides were unremarkable.
The obturator nerve is rarely injured in isolation. There are many possible causes of obturator neuropathy, including injury or compression due to abdominal or pelvic surgery, pregnancy and delivery, pelvic tumor, fascial entrapment, osteitis pubis, pelvic fracture or dislocation, osteoporosis, penetrating wounds, and obturator hernia. Pelvic fractures as a result of direct trauma or indirect translation of forces through the pelvis can injure pelvic soft tissues, including the obturator nerve. Anteroposterior pelvic compression commonly fractures the pubic rami [2]. Fracture-prone areas of the pelvis include the pubic rami, acetabula, sacroiliac joints, and alae of the ilium. Insufficiency fracture of pubic rami due to osteoporosis [3] or stress fracture involving inferior and superior ramus in a case of osteopenia due to secondary hypogonadotrophic hypogonadism [4] have been reported. In general, stress fractures of the pelvis are significantly less common accounting for 1% to 7% of reported stress fractures [2]. Certain patient populations, however, may incur pelvic bone stress injuries at a significantly higher rate. For example, pelvic bone stress injuries account for approximately 4% stress fractures in track and field athletes [5]. Female military recruits have the highest reported incidence at 22% of all stress fractures [6]. Furthermore, straddle pelvic stress fracture in female marathon runner [7] and stress fracture of the pubic ramus in female recruits [8] has been reported. In the latter case, a detailed investigation showed that longer stride length required during marching has been the cause of stress fractures in female recruits and reduction in stride length reduced such incidences. Longer stride causes anterior tilt of the pelvis and contraction pull by the adductors group of muscles on the pubic ramus. Tilting appears exaggerated in the female because of the wider pelvis and greater superficial fat. Furthermore lesser bone masses in female a contributing factor. Additionally, entrapment of obturator nerve in association with a fracture of the pelvic ring [9] and obturator nerve palsy due to fixation of an acetabular reinforcement ring with transacetabular screws have recently been reported [10].

A descriptive study of the lumbar plexus concluded that there is a wide variety of anatomical variations that is clinically relevant [1]. Anatomic variability in the obturator nerve may occur in its divisions and subdivisions. For instance, the point of division of the obturator nerve into anterior and posterior divisions were intrapelvic (23.22%), within the obturator canal (51.78%), or in the thigh (25%) [1]. In the present variant, the obturator nerve displayed an alternative course but upon approach to the obturator canal divided in the typical manner within the obturator canal. Significantly, understanding variations in the branching of obturator nerve

**Figure 1.** Left hemi-section of the pelvis showing variant obturator nerve in the osseus tunnel (left panel). Right hemi-section shows usual course of obturator nerve along with the vasculature. (A: left obturator nerve; B: left obturator artery; C: left obturator vein; D: left superior pubic rami–osseus tunnel is chiseled open to expose the left obturator nerve; E: pubic symphysis–midsagittal section) Right hemi-section of the pelvis showing right obturator neurovascular bundle. (F: typical morphology)

**Figure 2.** A closer view of the left variant obturator nerve in the exposed osseus tunnel along with obturator vasculature coursing normally. (A: left obturator nerve; B: left obturator artery; C: left obturator vein; D: left superior pubic rami–osseus tunnel is chiseled open to expose the left obturator nerve; E: pubic symphysis–midsagittal section)
Uncommon course of obturator nerve at the obturator canal or in the inguinal region are important in successful administration of regional anesthesia [11]. However in the present case, uncommon course through an osseus tunnel would not interfere with the administration of successful regional anesthesia.

In the present case, an uncommon alternative route for the obturator nerve through an osseus tunnel in the superior pubic ramus represents a detrimental outcome in the event of a pelvic fracture involving the pubic ramus. In conclusion, the uncommon course of the obturator nerve through an osseus tunnel in the superior pubic ramus while rare a clinician must be aware of such possibilities in evaluating a patient with pelvic fracture or surgical procedure involving the pelvis. It is especially important in evaluating populations that are prone to pelvic fracture (elderly women, competitive track and field female athlete, young female army and navy recruits).

References