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CT Cavernosography: A New Method for Evaluating Venous Incompetence in Impotent Patients

Background/Objective: Cavernosography is traditionally recognized as an imaging modality for evaluation of venous leakage in impotent men. We introduce CT cavernosography as a novel method for demonstrating leaking veins.

Patients and Methods: Sixty-seven patients diagnosed as venous incompetence by Doppler study, and eight normal subjects were enrolled into the study. After intracavernosal injection of papaverine, normal saline was injected into the corpora cavernosa and the injection rate was gradually increased and the penis was observed to obtain the injection rate causing erection. Then contrast media was injected into the corpus cavernosum with obtained injection rate followed by CT scan of the penis and pelvis.

Results: In the first group, 63 patients (94%) had venous leakage by CT cavernosography. In this group, full erection was observed at the rate of 36 ml/min of saline injection in three patients and 24 ml/min in one patient. In 46 patients (73%), erection was induced with saline injection at the rates of 48-120 ml/min, and in 17 patients (27%) no full erection was demonstrated even at the injection rate of 120 ml/min. In the 2nd group we observed full erection after saline injection at the rates of 36 ml/min and 24 ml/min in five and three patients, respectively.

Conclusion: Beside the capability of CT source images in precise visualization of all leaking veins without superimposition of bony structures, different techniques of two- or three- dimensional reformation enable us to demonstrate the anatomy of the penis and the leaking veins elegantly for further surgical planning.

Keywords: Impotence, Computerized Tomography, Cavernosography

Introduction

Venous incompetence as a cause of vascular impotence is usually evaluated by cavernosography and cavernosometry¹ Various methods of cavernosometry, including injecting saline at different rates and measuring intracavernosal pressure and gravity cavernosometry by placing saline in different heights have been introduced.²⁻⁴ Cavernosography is performed by fluoroscopic-guided intracavernosal injection of contrast medium and obtaining radiographic images at different angles which is a time-consuming and difficult method needing multiple injections.^{5,6} Herein, we introduce a novel method of cavernosography with multi-slice spiral computed tomography (CT) scanning with intracavernosal injection of contrast media at different rates by means of power injector and subsequent obtaining and reconstructing of images in two and three dimensional (2D & 3D) formats. To the best of our knowledge, this method has not been introduced in the English literature so far.

Patients and Methods

The protocol for the research project has been approved by the Ethics Committee of Iran University of Medical Sciences and it conforms to the provisions of the Declaration of Helsinki (as revised in Edinburgh 2000).

From October 2007 to February 2009, 67 patients in whom venous incompetence had been diagnosed by an experienced urologist on the basis of Doppler examination criteria [end diastolic velocity (EDV) of more than 3 cm/s and peak systolic velocity (PSV) of more than 30 cm/s during at least 30 minutes of the study after intracavernosal injection of 60 mg papaverine], were enrolled in the study (group 1).

We also included eight subjects in whom the history and clinical examination of impotence were present without the Doppler criteria of vascular impotence (impotence of other causes) as group 2. The objectives and methods of the study were explained to all subjects and their written informed consent was obtained.

At first, 60 mg papaverine was injected into the corpus cavernosum by means of a 25-Gauge fine needle on the CT table while an elastic band had been ligated at the penile base followed by manipulation of penis for one minute to distribute papaverine uniformly in the entire length of the corpora cavernosa. Then the elastic band was released and a 19-Gauge scalp vein inserted into one of the corpora cavernosa and connected it to the power injector (Medrad, USA). Sterile normal saline (N/S) solution was injected into the corpus cavernosum in multiple steps gradually increasing the injection rate and observing the penis for signs of erection. We started saline injection at the rate of 12 ml/min (0.2 ml/s) observing the penis for at least 3 minutes after saline injection. In the absence of erection, each time we repeated the exam by adding 12 ml/min to the injection rate (24, 36, 48, and...ml/min). We discontinued saline injection at the rate of more than 120 ml/min (2 ml/s) in the absence of erection in all steps. In each step, when full rigid erection, usually accompanied by patients' sensation of fullness or pain was met, the injection was stopped and immediately after that, diluted contrast medium [including 50 ml Visipaque 320 mg (Amersham health, Netherlands)] diluted by 30 ml of N/S was injected into the corpus cavernosum at the same rate. Then pelvic cavity CT scan was carried out by means of light speed 4 slice General Electric machine (Milwaukee, USA) and acquisition protocol of 1.25 mm slice thickness, 0.6 mm interval, 1.5:1 pitch and 200 mm field of view and the obtained source images were reconstructed with a 3-mm-thick maximum intensity projection

(MIP) protocol in axial (Fig. 1), coronal (Fig. 2) and sagittal planes as well as volume rendering (VR) protocol (Fig. 3). We observed the source and reconstructed images in the workstation to search for leaking veins. After intracavernosal injection of contrast media at the mentioned rates, bilateral opacification of both corpora without opacification of the pelvic veins was consistent with the normal veno-occlusive mechanism.

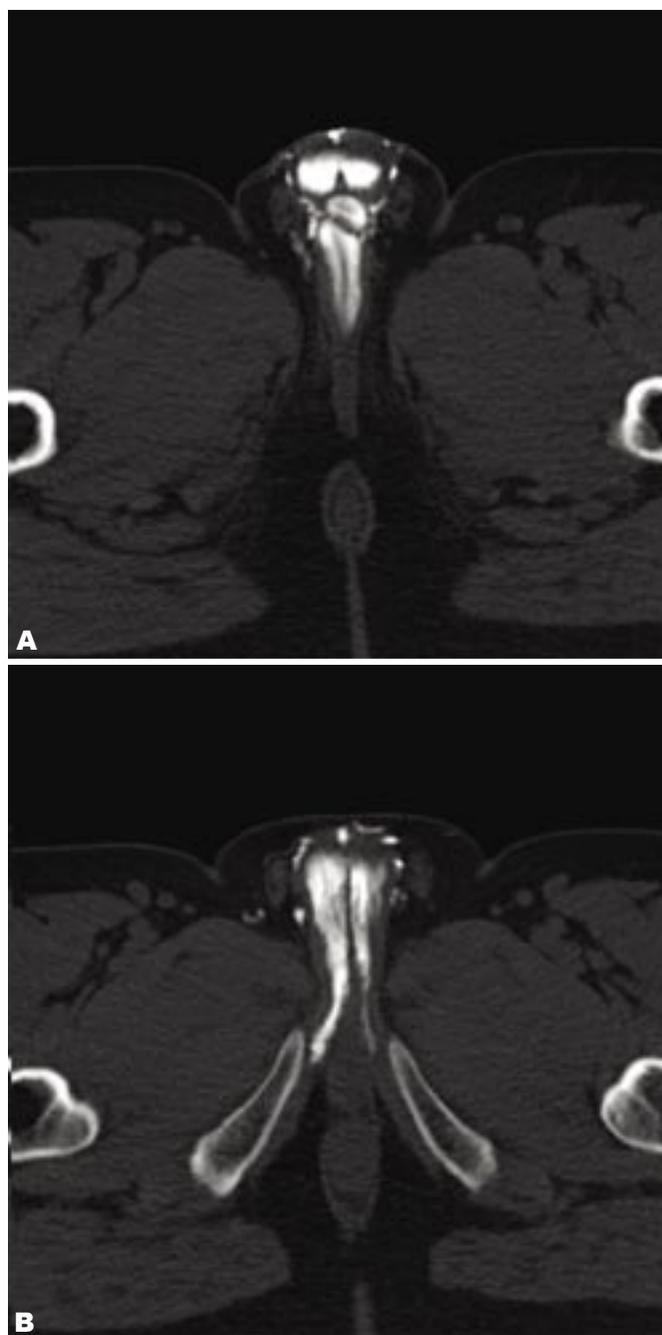


Fig. 1. CT source images in the axial plane from different levels (A&B) display opacification of corpora cavernosa as well as leaking veins.

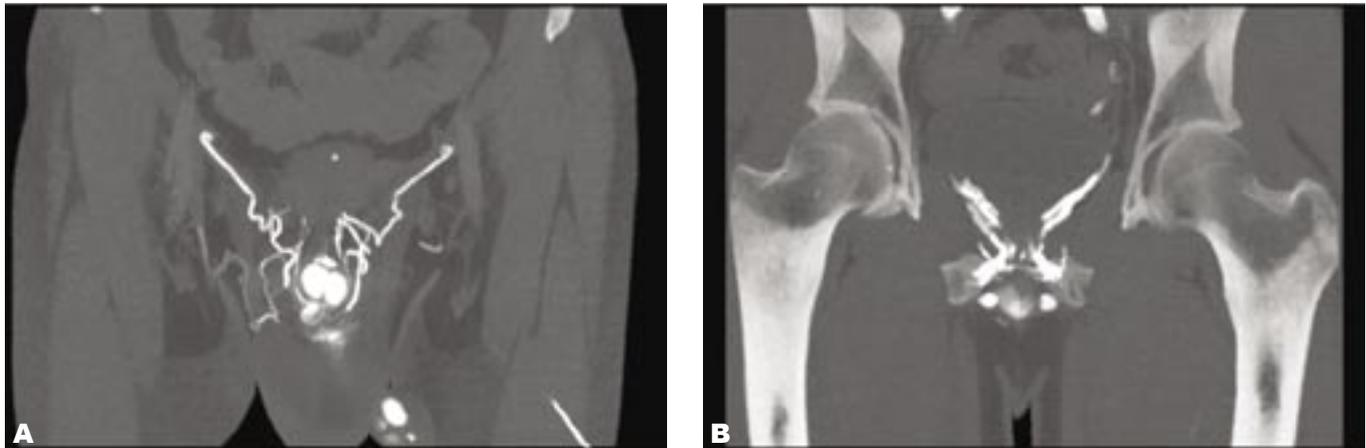


Fig. 2. Two selected reformat images with MIP protocol in the coronal plane from anterior (A) to posterior (B) show leaking veins

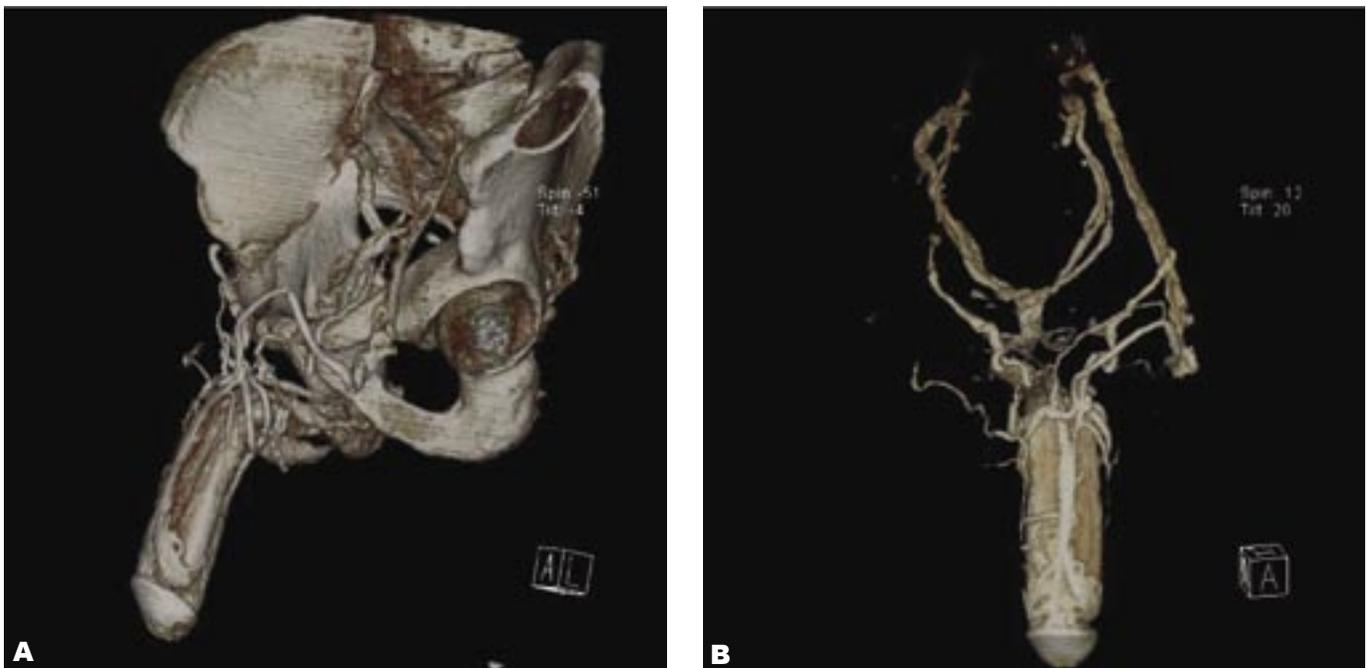


Fig. 3. VR techniques for demonstrating the anatomy of the penis in the sagittal plane and leaking veins three dimensionally from different views (A-B). The bony structures could be excluded (B).

Results

Sixty-seven patients in the first group (age range, 24-56 years; mean age, 36.6 ± 7.5) and eight subjects in the 2nd group (age range, 22-41 years; mean age, 32.1 ± 7.1) were enrolled in the study. None of the subjects in both groups experienced full rigid erection at the rate of 12 ml/min of saline injection. In the first group, 63 patients (94%) had venous leakage by CT cavernosography, but in the others (6%), no evidence of venous leakage was found. In this group, full erection was observed at the rate of 36 ml/min of saline injection in three patients and at 24 ml/min in one patient. Furthermore, in 46 patients (73%), erection was induced with saline injection at the rates of 48-120 ml/min and in 17

patients (27%) no full erection even at the injection rate of 120 ml/min was demonstrated. On the other hand, in the second group, we observed full erection after saline injection at the rates of 36 ml/min and 24 ml/min in five and three patients, respectively. There were no serious complications during our study in either group.

Discussion

In the critical cases of venous incompetence, the leaking veins are usually demonstrated by cavernosography.¹ In conventional cavernosography, images with different angles should be obtained to evaluate all the leaking veins and to overcome the superimposition of bony structures of the pelvis,

which each time needs different contrast injection with high concentration to opacify tiny pelvic and penile veins.^{5,6}

We believe that CT cavernosography in the patients with venous leakage can precisely demonstrate all the leaking veins, even the tiny ones including the retrocrural, retropubic and suprapubic venous plexus without superimposition of bony or other pelvic structures and show their communication with main pelvic veins with only one contrast injection. Moreover, the anatomic details may be precisely displayed in different 3D formats which will be of considerable importance in surgical planning. Furthermore, because of higher contrast resolution of CT scan and fluoroscopy, lower volume of contrast medium with higher concentration may be used in comparison with conventional radiography.

In all the patients in whom erection was induced at injection rates higher than 48 ml/min, we showed venous leakage. All the patients who did not have venous leakage reached full erection at the injection rate of 36 ml/min or less, hence we may consider the injection rate of 36 ml/min as cutoff point and consider the patients who developed full erection with the injection rate of 36 ml/min or less as normal veno-occlusive mechanism. However, the result of our study

should be replicated in other investigations.

We found out that CT cavernosography can elegantly depict the full details of the leaking venous channel in the penis and pelvis and should be considered as a satisfactory alternative to the other conventional methods of cavernosography.

Acknowledgments

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