

## CT Demonstration of the Extensive Extension of the Emphysematous Gangrene of the Lower Extremity Extending to the Body : A Case Report<sup>1</sup>

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Emphysematous gangrene of the lower extremity in a diabetic patient due to minor trauma is being presented. The gas originating from the extremity extended along the fascial planes into the pelvic cavity, scrotal region, retroperitoneal space, and abdominal wall. CT demonstrated the pathways of upward extension of emphysematous gangrene. Anatomic pathways of the spread of the disease are insertions of the iliopsoas, piriformis and obturator internus muscles, and their fascial investments, and the endopelvic fascia. Anatomic pathways on CT and the role of CT are discussed.

**Index Words :** Abdomen, CT  
Extremities, radiography  
Retroperitoneal space, CT

Emphysematous gangrene of the lower extremity is associated with major trauma, intraabdominal disease, and non-traumatic metastatic (hematogenous spread of gas-forming infection) gas gangrene(1). In previous articles, the extension of a retroperitoneal inflammatory process along the fascial planes to the lower extremity was discussed(1, 2). To our knowledge, however, previous investigators have not specifically addressed the possibility of spread of the disease process to the opposite direction.

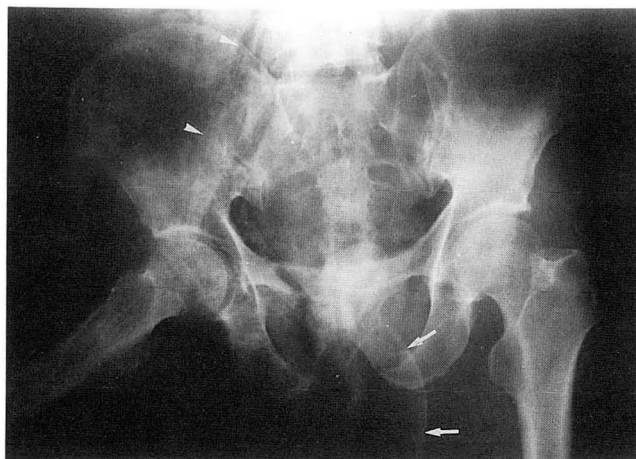
We recently experienced a case of the emphysematous gangrene of the lower extremity in a diabetic patient with upward extension along the fascial planes into the retroperitoneal space, scrotal region, and abdominal wall.

### CASE REPORT

A 57-year-old man with diabetes mellitus was hospitalized because of vomiting, fever(37.7°C), and pain in the right thigh due to falling on the floor. On admission, the right thigh was swollen and tender. Initial plain X-ray on admission showed a normal bowel gas

pattern in the abdomen. Pain, redness, and crepitant change in the right thigh were aggravated, however, and bullous lesion and bluish discoloration of the thigh developed after admission. The thigh became more swollen, reddish and tender.

Plain radiographs of the right lower extremity, hip, and simple abdomen taken 10 hrs after admission showed mottled and streaky air of soft tissue in the thigh, pelvis, and large round ballooned scrotum



**Fig. 1.** Plain radiograph taken 10 hrs after the admission shows mottled, streaky air of soft tissue in the right hip joint and femur, large round ballooned scrotum(arrows), extending upward into pelvis and retroperitoneum along the right iliopsoas muscle (arrowheads).

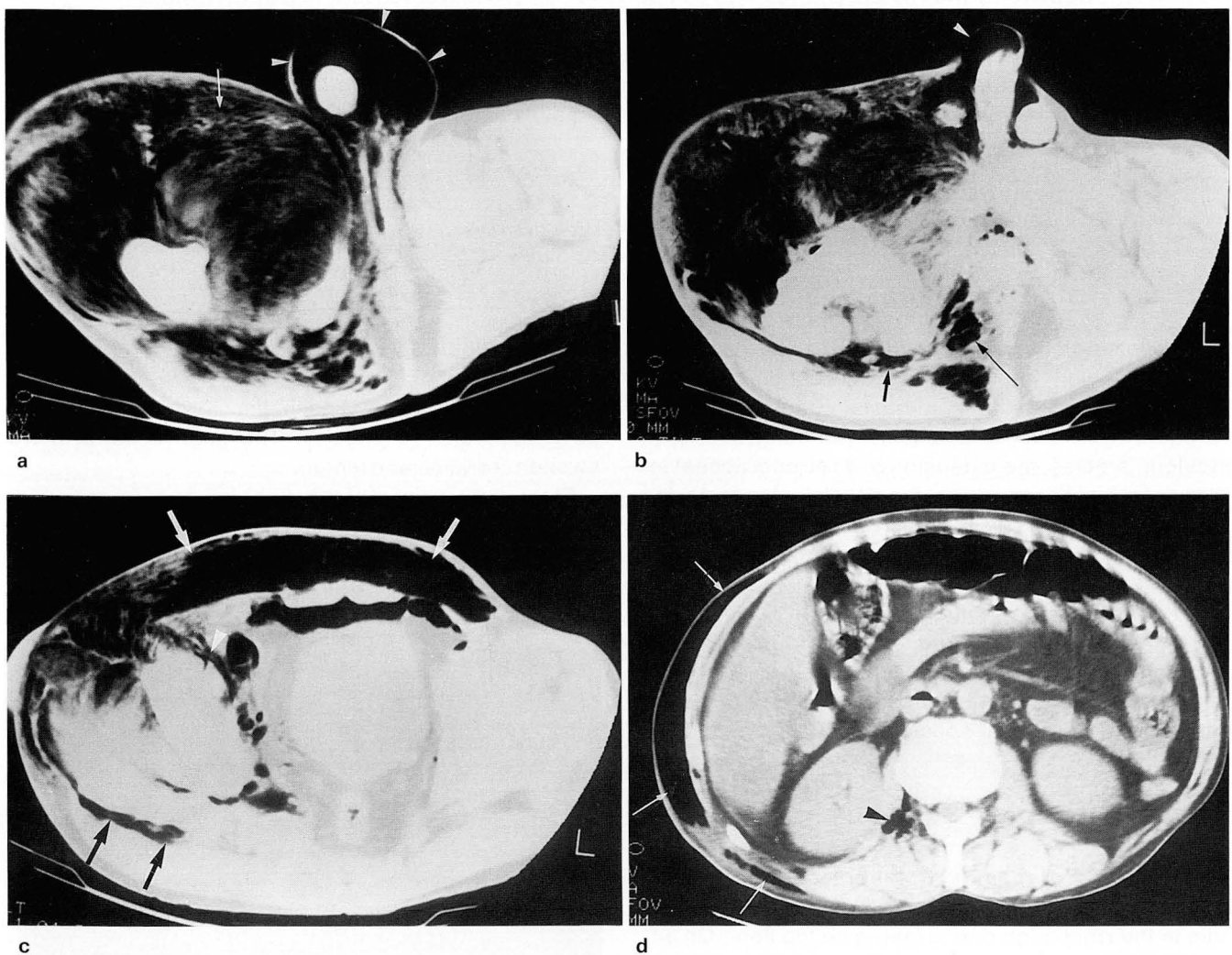
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extending upward into the pelvis and retroperitoneum along the right iliopsoas muscle. (Fig. 1.). Duplex doppler ultrasonographic examination of the right lower extremity failed due to subcutaneous air. CT scan revealed emphysematous myositis or gas gangrene of the right lower extremity, and a small amount of air shadow in the right pararectal space. There was a large amount of air around the right testis of entire scrotum, and medial aspect of the obturator internus muscle. Upwardly, gas shadows were also noted adjacent to the greater trochanter, medial aspect of the iliopsoas muscle, anterior abdominal wall, and posteromedial aspect of the right psoas muscle(Fig. 2.).

External wound culture and aspiration culture from subcutaneous tissue was carried out. Fasciotomy was planned, but not performed due to acute renal failure. Twenty-one hours after admission, the patient expired. Blood and the necrotic tissue culture revealed coagulase negative *staphylococcus* and *Clostridium septicum*.

## DISCUSSION

Emphysematous gangrene of the lower extremity is associated with severe trauma involving penetrating wounds, compound fractures, extensive soft-tissue injury, and rarely intraabdominal diseases(1).



**Fig. 2.** a. CT scan at the level of the lesser trochanter of the right femur shows emphysematous gangrene(arrow). Also, The large amount of air around the right testis of entire scrotum(arrowheads) is visualized.  
b. At three centimeter above a, abnormal gas(arrow) is seen adjacent to the greater trochanter, where the piriformis muscle inserts. Gas is also present in right pararectal(long arrow), and scrotal region(arrowhead).  
c. Scanning at the level of mid-pelvis, the gas(arrow) is tracking into the interfascial planes between Gluteus maximus and Gluteus medius muscles through the sciatic foramen. The piriformis muscle and gluteal vessels transverse this foramen. Gas is collected in right iliopsoas muscle(arrowhead) and anterior abdominal wall(long arrows).  
d. At two centimeter below the left renal hilum, upward extension of the gas is visualized at the posteromedial aspect(arrowhead) in the right psoas muscle, and posterolateral aspect of the abdominal wall(long arrows)

The mode of spread of this gangrene depends on the anatomical pathways of extrapelvic spaces. Meyers and Goodman(3) have established the correlation between anatomic pathways and radiologic documentation of the extrapelvic spread of disease. They have, however, focused on the downward extrapelvic spread of intrapelvic process. The present case showed the possible extension of disease from extrapelvic to intrapelvic spaces. Gas gangrene of the right lower extremity spreads upwardly through the insertions and fascial investments of the psoas major and iliacus muscles on the lesser trochanter, of the piriformis muscle through the greater foramen on the greater trochanter, and of the obturator internus muscle through the lesser sciatic foramen on the greater trochanter. The parietal layer of the endopelvic fascia covering the intrapelvic portion of the obturator internus and piriformis muscles is directly continuous above within the transversalis(abdominal) fascia lining the abdominal cavity, the potential routes for the spread of disease upwardly. These pathways are same as those involved in extrapelvic spread, as described by Meyers and Goodman.

Gas collection in the scrotum and penis is not only a necrotizing fascitis confined to the male peritoneum and genitalia, but also an extension of emphysematous gangrene. Based on our findings and a knowledge of the anatomy of the male genitalia, the pathway of extension of subcutaneous emphysema is same as that Fournier's gangrene(4, 5, 6). The pathway of accumulation of gas in the scrotum can arise from two sources (5) : one is infection of the lower urinary tract and the other is perirectal ; it can penetrate Colles' fascia, and involve the penis and scrotum by direct extension along the aforementioned fascial planes. Colles' fascia is not a continuous layer but rather a condensation of fibrous tissue with interstices that allow the spread of a perirectal process to involve the scrotum and penis(5).

In our case, two pathways were observed. Gas collection in the ischiorectal space spread first to the scrotal fascial planes and then gas collection spread to Colles' fascia via the endopelvic and transversalis fascia. Gas collection in the pelvic cavity ascends to the infrarenal spaces and then posteromedially to the psoas muscles at the inferior pole of the right kidney.

The rapidity of gas accumulation, the necrotizing and

destructive process and the presence of an underlying condition or chronic disease such as diabetes mellitus may contribute to the extension of emphysematous gangrene(7). The fascial planes of muscles in the thigh, pelvic cavity, scrotal region, and retroperitoneum may be the potential routes or pathways in inflammatory disease. Bidirectional spread of disease originating either in the extrapelvic or intrapelvic and retroperitoneal space may be possible. Familiarity with the connection of the fascial plane provides the radiologist with an explanation of the extension and process of an inflammatory disease.

Diseases arising from the one compartment may first manifest themselves by signs and symptoms remote from their sources of origin. Radiologic evaluation may be crucial in redirecting the diagnostic and therapeutic approach as well as in documenting the extent of disease. CT is a valuable and important method in the assessment of the extent of subcutaneous emphysema(1, 2, 3, 7). If emphysematous gangrene in immune suppressed patients is clinically suggested, CT scan should therefore include the lower extremity, pelvis, and lower abdomen because of rapid progression and bidirectional extension of the gas.

## REFERENCES

1. Jager GJ, Rijssen HV, Lamers JJH. Subcutaneous emphysema of the lower extremity of abdominal origin. *Gastrointest Radiol* **1990** ; 15 : 253-342
2. Meshkiov SL, Seltzer SE, Finberg HJ. CT detection of intraabdominal disease in patients with lower extremity signs and symptoms. *J Comput Assist Tomogr* **1982** ; 6(3) : 497-501
3. Meyers MA, Goodman KJ. Pathways of extrapelvic spread of disease : anatomic-radiologic correlation. *AJR* **1975** ; 125 : 900-909
4. Gaeta M, Volta S, Minuti A, Bartiromo G, Pandolfo I. Fournier's gangrene caused by a perforated retroperitoneal appendix: CT demonstration. *AJR* **1991** ; 156 : 341-342
5. Spirnak JP, Rensick MZ, Hampel N, Pesky L. Fournier's gangrene: Report of 20 patients. *J Urol* **1984** ; 131 : 289-291
6. Begley MG, Shawker TH, Robertson CN, Bock SN, Wei JD, Latze MT. Fournier's gangrene : Diagnosis with scrotal US. *Radiology* **1988** ; 169 : 387-389
7. Velasquez AR, Yoder IC, Velasquez PA, Papanicolaou N. Imaging the effects of diabetes on the genitourinary system. *RadioGraphics* **1995** ; 15 : 1051-1068

## 체부로의 광범위한 파급을 보인 하지의 기종성 괴사의 CT 소견 : 1예 보고<sup>1</sup>

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당뇨병 환자에서 경미한 손상에 의하여 하지에 발생한 기종성 괴사(emphysematous gangrene) 1예를 경험하였다. 하지에서 부터 생긴 가스는 근육층을 따라 위로 골반강, 고환, 후복막강, 복벽에 도달하였다. 전산화단층촬영(CT)소견이 장요골근, 이상근, 폐쇄근, 및 그 근막, 그리고 복내근막을 통한 기종성괴사의 위쪽으로의 파급 경로를 잘 보여주고 있었기에, CT상의 해부학적 경로와 그 역할에 대하여 알아 보았다.