

## 가

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: 94 1 2001 8 4 가

: 4 가 3 ( )

, 가 1

4 2 Non-clostridial infection 1  
1 가 (Gas gangrene)

: 가 가 (Gram stain),

: 가 , 가

:

가  
21), clostridium 가 (gas  
gangrene, clostridial myonecrosis)  
MacLennan<sup>13)</sup>, Altemeier Culbertson<sup>2)</sup> 가  
non-clostridial infection  
. 가 3가  
, , clostridial myonecrosis  
clostridium species  
, 가  
, clostridial cellulitis clostridium  
cellulitis . , non-clostridial infection  
clostridium 가  
15).  
가 ,  
clostridium  
, 가  
, 가  
5,18). 가 clostridium perfringens  
가 가  
가 12).  
가 0.03% ~ 5.2%  
1), 가 2~8  
4). 900~1000  
가 가 6). 가  
가 가  
13)  
가 20).  
가 36% 14) 90%  
가  
1994 1 2001 8 4  
가

1.  
1994 1 2001 8 7 ,  
2 4 51 75  
62 .  
, , ,  
.  
2.  
, 가  
(clostridial myonecrosis, gas gangrene) 가  
가 (clostridial cellulitis, non-clostridial  
infection)  
가 , local symptom  
, , 가 (brownish  
drainage), (Bronze discoloration), ,  
(Fig.1A, 1B), general symptom  
fever, sepsis .  
가 가  
, general condition  
, local symptom 가  
가  
, 3  
8)(Table 1).

**Table 1.** Symptoms and Progress of Gas Forming Infections

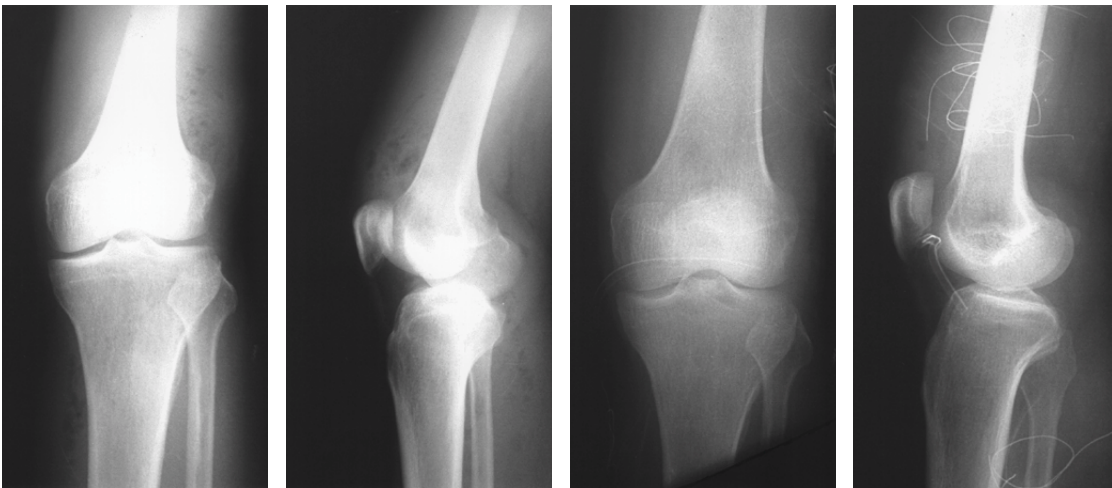
	Gas gangrene (=Clostridial myonecrosis)	Clostridial cellulitis Non-clostridial infection
Local symptom	Pain( sudden onset ) Swelling & discharge Foul odor Crepitation	Not so severe ( only swelling )
Systemic symptom	Fever Sepsis Renal failure Tachycardia Hemolysis Jaundice	Often not affected
Progress	Rapid( < 3days )	Slow( > 3days ) or none



**Fig. 1 :** The photographs and radiographs of gas gangrene

**A, B :** The necrosis of foot is rapidly progressing to the leg.

**C, D :** The anteroposterior radiographs show the streak or feather-like gas shape in the muscle.



**Fig. 2 :** The radiographs of non-clostridial gas forming infection(Klesiella infection)

**A, B :** The preoperative anteroposterior and lateral radiographs show the round or oblong gas shape.

**C, D :** The anteroposterior and lateral radiographs show the disappearance of gas after the surgical debridement.

3.

<sup>8)</sup>(Fig. 2A, 2B, Table 2).

2

,가

가

(Fig. 1C, 1D), 가

가

가

가

4.

가

**Table 2.** Radiographic Differences of Gas Forming Infections

	Gas gangrene	Clostridial cellulitis Non-clostridial infection
Localization of gas	Intramuscular & subcutaneous	Subcutaneous
Shape of gas	Streak or feather-like	Round or oblong

가 . 3 2 1 , . Non-  
clostridial infection 1 (Fig. 2, Table 4).

gram stain  
15)(Table 3). Gram stain Gram positive 가 3  
peptostreptococci clostridium , 1 clostridium  
IV penicillin , perfringens가 가 , 1  
surgical debridement 가 . Bacteroides fragilis Non-clostridial infection  
, 가 가 , 가 , 1 . 3  
가 . Non-clostridial infection  
surgical debridement 1 klebsiella pneumoniae가  
. Gram negative non-clostridial infection ,  
bacteroides coliform  
가 가 bacteroides . coliform 가 (Fig. 2C,  
klebsiella, E.coli, enterobacter, pseudomonas 2D), (Table 4).  
surgical debridement 가 4  
bacteroides  
clindamycin chloramphenicol , coliform  
gentamycin cephalothin . 가  
surgical debridement  
가 가 clostridial myonecrosis(gas  
antitoxin . antitoxin gangrene), clostridial cellulitis, non-clostridial infection  
(hyperbaric oxygen therapy)가 , 3가 8). 가  
antitoxin 가 , clostridial infection non-clostridial infection  
, clostridial infection  
8). gas gangrene  
clostridial cellulitis . clostridial

**Table 3.** Differential Diagnosis of Gas Forming Infections

Gram stain	Gram positive		Gram negative	
	Cocci	Rods	Foul odor(+)	Foul odor(-)
Presumptive Dx.	Peptostreptococci	Clostridia	Bacteroides	Coliforms
Treatment	Wide excision & IV penicillin	Open amputation or wide excision & IV penicillin ( hyperbaric oxygen if possible )	Wide excision & IV clindamycin or chloramphenicol	Wide excision & IV gentamicin or cephalothin

Case	Gender /Age	Presumptive diagnosis	Treatment	Result of culture	Definitive diagnosis	Clinical result
1	F/75	Gas gangrene	Hip disarticulation & antibiotics	Clostridium prefringens	Gas gangrene	Improved
2	M/61	Gas gangrene	AKA* & antibiotics	Bacteroides fragilis	Non-clostridial infection	Improved
3	M/51	Non-clostridial infection	I and D <sup>+</sup> & antibiotics	Klebsiella pneumoniae	Non-clostridial infection	Expired (due to sepsis)
4	F/60	Gas gangrene	AKA & antibiotics	No growth	Unknown	Improved

**Table 5.** Predisposing factors of patients

1	F/75	Spontaneous	DM
2	M/61	Spontaneous	Liver cirrhosis
3	M/51	Spontaneous	DM, Liver cirrhosis
4	F/60	Spontaneous	DM

infection		가		case 3	Klebsiella pneumoniae	non-
	,		.	clostridial infection		
Gas gangrene		가	, , clostridial		sepsis, acute renal failure	
					predisposing factor	가
cellulitis		가				
debridement		13, 17)		가	가	
	90%	clostridium				
clostridial cellulitis		2%		penicillin, gentamicin, clindamycin	triple coverage	
가		3).		20), culture 가		
		clostridial			clostridium	
infection	가			penicillin drug of choice penicillin 3		
가				3 8, 11). Penicillin		
	,			erythromycin cephalothin 22).		
		가			가	
가	12).	가			가	surgical
Predisposing factor			,	debridement	가	
	15),		,			가
가 predisposing factor .				7, 19). 가	Escherichia coli infection	
,	20).			가 가	8). 가	
가 가 가		가		가 , 가	가	

가 , 2  
가  
가 9,  
10, 16)  
Vibrio  
vulnificus cellulites necrotizing fasciitis가  
Vibrio  
Gram stain Gram negative Gram positive  
Clostridium  
가  
surgical debridement  
tetracycline, aminoglycoside  
가 ,  
Gram stain  
(가  
) 가  
,

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## Abstract

## Differential diagnosis and its treatment of gas forming infections

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**Purpose** : To establish the guidelines for the differential diagnosis and proper initial treatment of the gas forming infections through the review of literature and our clinical experiences.

**Materials and Methods** : The radiological findings, clinical course, gram stain, bacterial culture, predisposing factors and treatment of four cases of gas forming infections from January 1994 to August 2001, were retrospectively analyzed.

**Results** : Three cases diagnosed presumptively as gas gangrene were improved through amputation or disarticulation and intravenous antibiotics. One case diagnosed presumptively as non-clostridial infection was expired due to sepsis in spite of incision, drainage and intravenous antibiotics. In the bacterial culture, two cases were non-clostridial infection, one case was not able to diagnose and one case was clostridial myonecrosis(gas gangrene)

**Conclusion** : The gas forming infections are rare but life-threatening. When the proper initial treatment is delayed, the fatal complications may result. So, the presumptive diagnosis through gram stain, clinical course, radiological findings should be made as soon as possible, and according to which, the appropriate initial treatment, such as, surgical debridement, amputation, intravenous antibiotics must be started. The following treatments should be corrected by definitive diagnosis through the bacterial culture.

**Key Words** : Gas forming infection, Gas gangrene

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