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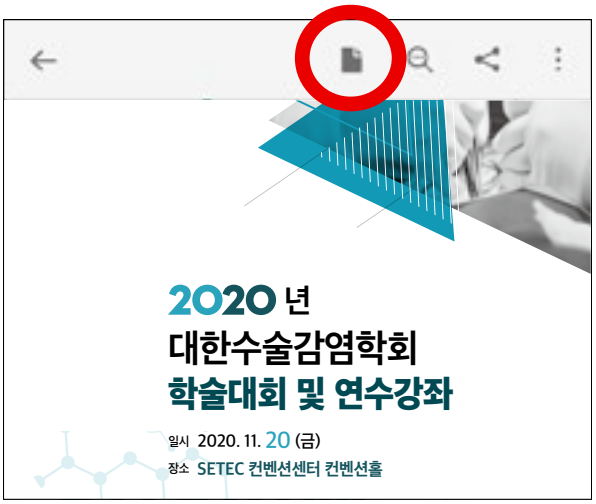
3. 화면 상단의 붉은 원 안의 표시된 부분을 누른다.



4. 화면 하단의 '페이지 단위'를 선택한다.

2020 년
대한수술감염학회
학술대회 및 연수강좌

일시 2020. 11. 20 (금)

장소 SETEC 컨벤션센터 컨벤션홀

대한수술감염학회
Korean Surgical Infection Society

INVITATION

안녕하십니까?

코로나 팬데믹 상황이 거의 일년이 다 되어가고 있지만
여전히 적응하기 힘들다고 느끼는 요즘입니다.
어서 빨리 이전의 삶으로 돌아갈 수 있기를 바라는 동시에 현 상황에서도
우리가 해야 할 일들은 굳건히 해 나가야 하기에 올해 미진했던 부분을 채우고자
11월에 학술 대회 및 연수 강좌를 준비했습니다.

이번 행사에서는 각 과의 전문가 선생님들을 모시고
각 외과 분야별 수술 부위 감염 예방에 대한 가이드라인과
실제 임상에서 적용되고 있는 상황에 대해 다루고자 합니다.
또한 수술 부위 감염이 발생되었을 경우 적용할 수 있는 적절한 처치 방법에 대해
경험이 많은 선생님들을 모시고 이론과 실제에 대해 듣는 자리를 마련했습니다.
또한 정책 세션에서는 코로나 19 발생 현황과 향후 대응 전략에 대해
질병관리청에서 강사를 모셨습니다.
국가 전반적인 대응 전략을 바탕으로 각 병원에서 대응 전략을 짤 수 있는
좋은 시간이 될 것으로 기대합니다.

회원 여러분들의 지속적인 관심과 도움으로 코로나 팬데믹 상황에서도
지난 7월 학술대회를 성공적으로 치를 수 있었습니다.
이번 행사도 지난 학술대회처럼 현장과 온라인을 동시에 진행하고자 합니다.

회원 여러분들의 적극적인 참여와 지원을 부탁드리며
이번 행사가 참여하신 모든 분들께 유익한 시간이 될 수 있기를 빕니다.
감사합니다.

대한수술감염학회 회장 강중구

PROGRAM

13:00 – 13:20	등록		
13:20 – 13:30	개회	강중구 대한수술감염학회 회장	
SESSION I. 수술부위 감염 예방		오태윤 성균관의대, 유대현 연세의대	
13:30 – 13:45	정형외과	장문종 서울의대 정형외과	06
13:45 – 14:00	신경외과	김태곤 차의과학대학 신경외과	14
14:00 – 14:15	비뇨의학과	유달산 울산의대 비뇨의학과	16
14:15 – 14:30	산부인과	이은주 중앙의대 산부인과	23
14:30 – 14:45	흉부외과	최재웅 서울의대 흉부외과	31
14:45 – 15:10	*Coffee Break*		
SESSION II. 정책세션		강중구 차의과학대학	
15:10 – 15:50	코로나 19 발생 현황과 향후 대응 전략	박현정 질병관리청 의료감염관리과	41
15:50 – 16:00	*Coffee Break*		
SESSION III. 다양한 수술감염에 대한 처치		장원호 순천향의대, 김한구 중앙의대	
16:00 – 16:20	신경외과 (개두술) 수술 후 감염과 적절한 처치	한성록 인제의대 신경외과	50
16:20 – 16:40	흉부외과 (심장수술) 수술 후 감염과 적절한 처치	홍준화 중앙의대 흉부외과	57
16:40 – 17:00	비뇨의학과 수술 후 감염과 적절한 처치	최훈 고려의대 비뇨의학과	71
17:00 – 17:20	정형외과 수술 후 감염과 적절한 처치	이정은 가천의대 정형외과	84
17:20 – 17:40	패혈증의 진단 및 적절한 처치	홍영기 일산병원 외과	90
17:40 –	폐회		

SESSION I.

수술부위 감염 예방

오태윤 성균관의대, **유대현** 연세의대

1

장문종 서울의대

EDUCATION

경희대학교 의과대학 졸업
성균관대학교 의학석사 및 박사

CAREER

분당서울대학교병원 정형외과 진료조교수
서울대학교 보라매병원 정형외과 임상부교수
대한정형외과학회
대한슬관절학회
대한관절경학회

Prevention of surgical site infections in orthopedic surgery
-Arthroplasty를 중심으로-

장문종 서울의대

Various patient-specific comorbidities and demographic factors increase risk of periprosthetic joint infection (PJI). Any joint infections, septicemia, active cutaneous or deep tissue infections, or blood transfusions are important risk factors. Patient-specific factors consist of uncontrolled diabetes, malnutrition, morbid obesity, smoking and alcohol consumption, immunocompromising diseases, drug use, and nasal carriage of S aureus.

● Risk factors

1. Diabetes

Diabetes is a risk factor for infection after general surgical and orthopedic procedures; however, total joint arthroplasty findings are varied. Although glycosylated hemoglobin (HbA1c) is used as a glycemic control indicator, it has not been predictive of infection.

Patients, with a sole diagnosis of well controlled diabetes, do not confer a clinically significant risk for PJI. However further evaluation and optimization are necessary for patients with uncontrolled diabetes. Severely uncontrolled diabetes is and absolute contraindication for arthroplasty (e.g., serum glucose ≥200 mg/dL). For those with HbA1c ≥8 to 9% or glucose levels between 180 to 200 mg/dL, optimization may be a

consideration in the preoperative period.

Preoperative identification of diabetic control should be assessed.

2. Poor nutritional status

Malnutrition is diagnosed if serum albumin is less than 34 g/L (healthy range is 34–54 g/L), or total lymphocyte count is less than 1200 cells per μL (healthy range is 3900–10 000 cells per μL). Proper nutritional optimisation can decrease periprosthetic joint infections.

Serum albumin 〈3.5 g/dL has been demonstrated to be an independent risk factor or SSIs/PJIs following total joint arthroplasty in multiple, large-scale studies. However other nutritional makers are poorly studied.

3. Obesity

Nationwide Inpatient Sample database38 showed that morbidly obese patients (BMI ≥40 kg/m2) had a higher infection risk than did non-obese patients (infection rate of 0·24% vs 0·17%; p=0·001).

Current evidence for or against PJIs in underweight patients are equivocal.

4. Smoking and alcohol

Smoking and alcohol consumption result in poor postoperative outcomes. Nicotine-mediated vasoconstriction has been postulated as the main cause for deficient wound healing.

5. Chronic kidney disease (CKD)

Patients with CKD are at increased risks for PJI, but require stratification to adequately assess their risk. Current evidence suggest that patients with

ESRD requiring hemodialysis fare worse than non-hemodialysis CKD and renal transplant patients.

6. Clotting disorder

7. Previous infection of the operative joint

TABLE 1. PJI rates for TJA following prior septic arthritis of same joint

Pooled Cohort Type (n)	PJI Rate (Same Joint)	95% CI
All studies, pooled (n=1300)	5.96%	4.24 to 7.94
One-Stage TJA, pooled (n=1020)	5.14%	3.31 to 7.36
Two-Stage TJA, pooled (n=280)	8.70%	5.77 to 12.49
Bacterial Septic Joint, pooled (n=977)	5.84%	3.97 to 8.05
TB/mycoplasma Septic joint, pooled (n=323)	6.09%	2.94 to 10.28
Adult-onset Septic Joint, pooled (n=717)	8.35%	6.48 to 10.55
Childhood-onset Septic Joint, pooled (n=583)	2.18%	1.26 to 3.70
Hip Septic Joint to THA, pooled (n=1037)	5.21%	3.50 to 7.21
Knee Septic Joint to TKA, pooled (n=263)	8.26%	5.30 to 12.15
Total Primary TJA (from literature) [146]	0.4%-1.5%	NA

PJI, periprosthetic joint infection; TJA, total joint arthroplasty; CI, confidence interval; TB, tuberculosis; THA, total hip arthroplasty; NA, not available

8. MRSA colonization

S. auresus screening and treatment are quick, inexpensive and simple and should be performed on all patients prior to arthroplasty.

9. Age

Findings from two studies suggested that patients 75 years old and above had an increased risk of SSIs following primary total hip arthroplasty.

10. Male sex

11. Depression

12. Steroid therapy

13. Cardiovascular disease and obstructive lung disease

14. Rheumatoid arthritis

15. Previous joint surgery

16. Preoperative anemia

17. Transfusion

The use of allogeneic and autologous blood transfusions in arthroplasty increases the risk of infection. Risk factors for transfusions include low preoperative haemoglobin, female sex, increased surgery duration, and high Charlson comorbidity index.

18. ASA grade of 〉 2

● Controversial issues of PJI prevention

1. Asymptomatic bacteriuria

Routine prophylactic antibiotic use is enough.

2. Use of personal protection suits

The use of personal protection suits does not reduce the rate of subsequent SSIs/PJIS

3. Colonoscopy or upper GI endoscopy after total joint arthroplasty

Colonoscopy and upper GI endoscopy have the potential to cause transient bacteremia, though the evidence is limited to support an associated risk of SSI/PJI. There is no evidence that administration of antibiotics prior to GI procedures decreases the risk of SSI/PJI and theis practice should be avoided. Further research is needed to see if this practice may be beneficial in selected or high-risk patients.

4. Doble gloving practice

During arthroplasty, 50-67% of surgical gloves are estimated to be perforated, which is associated with increased infection rates. To prevent this rise in infection, many surgeons have adopted double-gloving practices, although of unproven effectiveness.

5. Diluted betadine irrigation

Few studies have addressed intraoperative lavage during arthroplasties. A retrospective study reported a six-times reduction in infection rates with dilute betadine lavage, which might be an inexpensive method.

● Controversial issues of PJI diagnosis

1. Diagnostic accuracy and threshold of D-dimer in the diagnosis of PJI.

Recent literature supports the use of D-dimer as a serological marker for the diagnosis of PJIs. D-dimer has been shown to best perform at a threshold of 850 ng/mL/ However, this threshold was determined internally from a cohort in a single institution study. Further studies are needed in order to validate this threshold or establish a more rigorous threshold.

2. The role of alpha-defensin in the diagnosis of periprosthetic joint infections

Measurement of alpha-defensin in synovial fluid is a complement to existing diagnostic tests for PJIs

TABLE 1. Institutions studying the alpha-defensin laboratory-based immunoassay

Institution	N	Gold Standard	Sensitivity	Specificity
Rothman Institute	149	MSIS Criteria	97% (36/37)	96% (107/112)
Mayo Clinic Arizona	61	MSIS Criteria	100% (33/33)	95% (83/87)
Cleveland Clinic	111	MSIS Criteria	100% (24/24)	98% (53/54)
HELIOS ENDO-Klinik	156	MSIS Criteria	97% (28/29)	97% (123/127)
Cleveland Clinic Florida	70	MSIS Criteria	97% (34/35)	97% (34/35)
Combined	**547**		**98.1% (95%CI: 95-100%)**	**96.4% (95%CI:94-98%)**

3. Sonication of implants retrieved during explantation

Several studies have demonstrated that sonication of explanted orthopedic prosthesis is a viable method for detecting pathogens, particularly in the setting of culture-negative infections.

4. The level of leukocyte count and neutrophil percentage in the synovial fluid change with time following total joint arthroplasty

References

1. Second International Consensus Meeting (ICM) on musculoskeletal infection
2. Tucci G, Romanini E, Zanoli G, Pavan L, Fantoni M, Venditti M. Prevention of surgical site infections in orthopaedic surgery: a synthesis of current recommendations. European review for medical and pharmacological sciences. 2019;23(2 suppl):224-39
3. Kapadia BH, Berg RA, Daley JA, Fritz J, Bhave A, Mont MA. Periprosthetic joint infection. Lancet (London, England). 2016;387(10016):386-94.

MEMO

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CAREER

1996.03~2000.02	연세의대 세브란스병원 신경외과 전공의
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The prevention of surgical site infection in the neurosurgical field
- 신경외과영역에서의 수술부위감염의 예방

김태곤 차의과학대학

Surgical site infection (SSI) is one of the most preventable infections and acts as a great burden on the medical system in terms of the patient's morbidity, mortality and medical cost. Prevention of these SSI requires various and complex measures in the preoperative, perioperative and postoperative periods. However, the reality is that there are not many international guidelines for these surgical site infections, and even known guidelines are often unclear about evidence.

Thus, this presentation introduced guidelines and practical application of the existing known SSI in neurosurgical field, and described the diagnosis and treatment methods of SSI in neurosurgery field.

유달산 울산의대

EDUCATION

1992.03~1995.02	대전 동산고등학교
1995.03~2001.02	충남대학교 의과대학 의학과 (의학사)
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2018.03~	울산대학교 아산융합의학원 부교수

비뇨의학과

유달산 울산의대

- **AUA guidelines** (2008 published → 2011 reviewed → 2019 archived)
- **EAU guidelines** (→ → 2020 updated)
- **ASHP guidelines** (1999 ASHP, 1994 IDSA, 1993 SIS → 2015 Revised)

Goals of Antimicrobial Prophylaxis in Urologic Procedures

- **Prevention of bacteremia**
- **Prevention of surgical site infections**
- **Prevention of postoperative bacteriuria**
  (defined as $>10^3$ or $>10^4$ CFU/mL in symptomatic UTI and $>10^5$ CFU/mL in asymptomatic bacteriuria, within 30 days postoperatively)

https://www.ashp.org/surgical-guidelines

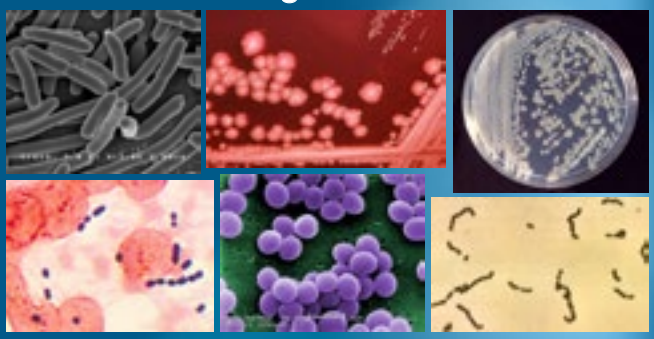
MEMO

Patient-Related Risk Factors

The presence of risk factors is a frequent indication for antimicrobial prophylaxis and, due to variability, a potential source of ambiguity in guidelines.
Urologic-specific risk factors include anatomic anomalies of the urinary tract, urinary obstruction, urinary stone, indwelling or externalized catheters, preoperative UTI, length of postoperative catheterization, mode of irrigation (closed versus open), and postoperative pyuria.

Int Urol Nephrol 2018;50:1923-1937

Organisms



https://ko.wikipedia.org/wiki/%EB%8C%80%EC%9E%A5%EA%B7%A0#/media/%ED%8C%8C%EC%9D%BC:EscherichiaColi_NIAID.jpg
https://en.wikipedia.org/wiki/Proteus_mirabilis#/media/File:Proteus_mirabilis_01.jpg
https://en.wikipedia.org/wiki/Enterobacter_cloacae#/media/File:Enterobacter_cloacae_01.png
https://en.wikipedia.org/wiki/Enterococcus#/media/File:Enterococcus_histological_pneumonia_01.png
https://en.wikipedia.org/wiki/Staphylococcus_aureus#/media/File:Staphylococcus_aureus_VISA_2.jpg
https://en.wikipedia.org/wiki/Streptococcus#/media/File:Streptococci.jpg

Surgical Wound Classification

Clean	**Uninfected operative site, with primary skin closure**
Clean-contaminated	**Entry into respiratory, alimentary, genital or urinary tracts**
Contaminated	**Fresh accidental wounds, major break in sterile technique, gross spillage from gastrointestinal tract or presence of acute but nonpurulent inflammation at the operative site.**
Dirty-infected	**Old accidental wound with devitalized tissue or presence of clinical infection or perforated viscera at the operative site. This definition implies that organisms that might cause postoperative infection were present at the operative site before surgery.**

Infect Control Hosp Epidemiol 1999;20:250

MEMO

Surgical Categories for Urological Surgery

	Some examples	SSI or UTI	AMP
Clean	*Radical, partial, simple, donor nephrectomy*	*SSI 1~4%*	No Single dose
Clean-contaminated	*Radical prostatectomy, nephroureterectomy, partial nephrectomy*	*SSI 4~10%*	Single dose ≤24 hours
Contaminated	*Radical cystectomy with urinary diversion*	*SSI 10~20%*	Single dose ≤24 hours ≤48 hours
Transurethral surgery	*TURP*	*UTI 4~10%*	Single dose ≤24 hours ≤72 hours
	TURBT	*UTI 1~4%*	No Single dose ≤24 hours

Curr Opin Urol 2017;27:112
Int J Urol 2016;23:814

Primary Antibiotic Recommendations by Procedure

	AUA	EAU	ASHP
Clean	Cefazolin	Optional	Cefazolin
Clean-contaminated	Cefazolin, Trimethoprim (TMP)-Sulfamethoxazole (SMX)	Optional	Cefazolin
Contaminated	Cefazolin (small bowel) Cefazolin + Metronidazole (MTZ), Cefoxitin, Cefotetan, or Ceftriaxone + MTZ, Ertapenem	Cefuroxim, Aminopenicillin/Beta-lactamase inhibitor + MTZ	Cefazolin + MTZ, Cefoxitin
TURP	TMP-SMX, Cefazolin	TMP ± SMX, 2nd/3rd generation cephalosporin, Aminopenicillin + Beta-lactamase inhibitor	Fluoroquinolone, TMP-SMX, Cefazolin
TURBT			

Int Urol Nephrol 2018;50:1923
J Urol 2020;203:351-356
https://uroweb.org/wp-content/uploads/19-Urological-infections_2017_web.pdf
https://uroweb.org/guideline/urological-infections/

Recommendations for Open or Robot/Laparoscopic Procedures

	AUA	CUA	EAU	JUA	ASHP
Clean					
Recommendation	High risk	N/A	High risk	High risk	High risk
Grade	–	–	C	B	A
Level of evidence	Ib, III, IV	–	3	IVa	–
Clean-contaminated					
Recommendation	All	N/A	All	All	All
Grade	–	–	C	B	A
Level of evidence	Ib, III, IB	–	3	IVa	–
Contaminated					
Recommendation	All	N/A	All	All	All
Grade	–	–	A (B)	B	A
Level of evidence	Ia, IV	–	1a (2a)	IVa	–

Int Urol Nephrol 2018;50:1923

MEMO

Recommendations for TUR Procedures

	AUA	CUA	EAU	JUA	ASHP
TURP					
Recommendation	All	All	All	All	All
Grade	–	A	A	A	A
Level of evidence	Ia/b, IV	IA	Ia	I	–
TURBT					
Recommendation	All	High risk	Varies with tumor burden and bacteriuria	All; None for low risk	N/A
Grade	–	C	C	B ; C_2	–
Level of evidence	Ia/b, IV	IB	$_2$b	III ; III	–

Int Urol Nephrol 2018;50:1923

SUMMARY

- There is consensus among guidelines that antimicrobial prophylaxis in **clean** procedures only be used for patients with risk factors.
- There is consensus among guidelines that all patients undergoing **clean-contaminated** procedures should receive antimicrobial prophylaxis.
- There is consensus among guidelines that all patients undergoing procedures involving the **use of intestine** should receive antimicrobial prophylaxis. Recommendation strength is supplemented by non-urologic data.

SUMMARY

- The use of antimicrobial prophylaxis for **TURP** is well studied relative to other urologic procedures and is recommended for all patients by each of the associations.
- Scarcity of data regarding antimicrobial prophylaxis for **TURBT** results in varied recommendations from the guidelines.

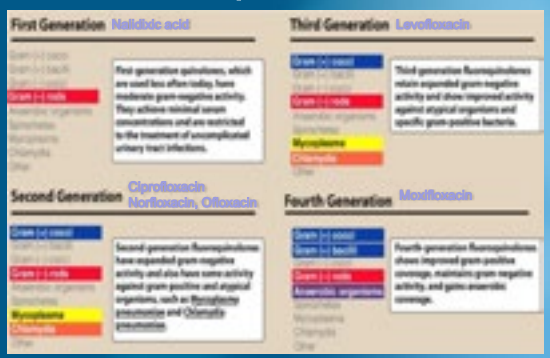
MEMO

Advantages of Fluoroquinolone

- Effective against many organisms
- Well-absorbed orally
- Well-distributed in tissues
- Relatively long serum half-lives (3–7 hr) and minimal toxicity
- Deep tissue and cell penetration
- Urinary tract infections, prostatitis
- Infections of skin and bones
- Penicillin-resistant sexually transmitted diseases
- Lower cost in synthesis with excellent activities

https://www.slideshare.net/saminathankayarohanam/4quinolones-and-folic-acid-antagonists-51480523

Antimicrobial Spectrum of Fluoroquinolone



https://www.slideshare.net/saminathankayarohanam/4quinolones-and-folic-acid-antagonists-51480523

FQ Resistant Gram (-) Bacilli

Data from published studies or national surveillance databases 2009–2014

Bennett HY, et al. Prostate biopsy related infection – Risk factors, prevention strategies and management approaches. Version: 2018-09-19. In: Bjerklund Johansen TE, et al, editors. Urogenital Infections and Inflammations. Berlin: German Medical Science GMS Publishing House; 2017-. DOI: 10.5680/lhuii000040

MEMO

https://i.pinimg.com/originals/a0/2a/55/a02a5527b49213f8933a3e8ba9b180c6.jpg

SUMMARY

Urologic Procedure	Fluoroquinolone
+ Bacteriuria	Effective to UTI
Urologic-specific risk factors	
G(-) bacilli (urinary) G(+) cocci (skin)	Effective against many organisms
Outpatient-based	Orally
Prophylaxis	Long half-lives, minimal toxicity, lower cost

Thank you for your attention!

MEMO

이은주 중앙의대

EDUCATION

1997~2002	삼성서울병원 인턴, 산부인과 레지던트
2002~2008	성균관대학교 분자치료연구센터 연구교수
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2018~	대한수술감염학회 학술위원
2018~	Obstetrics & Gynecology Science. 부편집장
2019~	대한단일공수술학회 총무이사
2019~	한국마이크로중력학회 학술위원

The prevention of Surgical site infection in Obstetrics and Gynecology

이은주 중앙의대

1. Background

Surgical site infection (SSI) is defined as "an infection related to an operative procedure that occurs at or near the surgical incision within 30 days." by the Centers for Disease Control. SSI represents a significant source of surgical morbidity and mortality, resulting in significant social and economic costs for the patients and health area system. SSIs complicate approximately 2% of hysterectomies and 3-15% of Cesarean section[1]. Therefore, despite of initiatives to prevent SSI, including prophylactic antibiotics and preoperative glucose control, SSIs are still a significant burden for gynecologic patients.

2. Classification of SSI

1. Superficial incisional: involving the skin and subcutaneous tissues
2. Deep incisional: involving the deeper soft tissues of the incision, such as muscle or fascia.
3. Organ/space: involving any part of the anatomy other than the incised body layers (skin, fascia and muscle layers), including pelvic or vaginal cuff abscess formation

3. Predisposing factors

• Poor nutritional state in elderly, obese, and diabetic populations can hinder wound healing and predispose patients to SSIs.

• Obese patients

  ‣ Poor oxygenation of tissues, decreased antibiotic penetration, altered immune function, and suboptimal metabolic function

• Patients with diabetes

  ‣ Similar to that of obese patients

• Immunocompromised patients

  ‣ HIV, long-term steroid use

• Smoking

• Patient's surgical history

  ‣ Increased operative time is associated with more iatrogenic surgical injury, exposure to exogenous pathogens, and potential contamination of the surgical field, as well as blood loss.

4. Potential bacterial implicated in gynecologic SSIs

Aerobic Gram Positive	Staphylococcus aureus Staphylococcus epidermidis Staphylococcus agalactiae Enterococcus faecalis
Aerobic Gram Negative	Escherichia Coli Klebsiella sp. Proteus sp. Pseudomonas sp.
Anaerobic	Bacteroides fragilis Prevotella sp. Peptostreptococcus sp. Clostridium sp. Fusobacterium sp. Gardnerella vaginalis Eubacterium sp.

5. SSI-prevention bundles

1) The C-section SSI rate was reduced by implementing the hospital infection control policies and a presurgical checklist[2].

- Hospital infection control policies
  - Jewelry reduction among labor and delivery suite staff.
  - Pediatrician attire was monitored (prohibition of long sleeves).
  - Alcohol dispensers on postpartum unit bathrooms for postpartum women
  - Antibiotics within 1h of surgery
  - Operation room doors were not closed appropriately during procedures-fixed, and monitoring continued
  - Education of team for appropriate SSI documentation and audited
  - Chlorhexidine preparation for surgeries
  - Hand hygiene monitoring
  - Alcohol dispensers installed in labor and delivery patient bathroom
  - Education and communication between patients, families and staff

- C-section presurgical checklist
  - Electric clipper for hair removal at incision site
  - Chlorhexidine for skin preparation
  - Antibiotic prophylaxis given before surgical incision
  - Cefazolin 1g (2g for obese women) IV bolus (30-60 min before procedure) and azithromycin 500 mg IV infusion (1h before surgery) given as broad-spectrum antibiotic prophylaxis
  - Traction of cord to remove placenta
  - Closure of deep subcutaneous layer 〉 2cm
  - Subcuticular suture for skin closure

2) The SSI bundle for major gynecologic surgery[3]

- Readiness
  - Establish standard preoperative care instructions and education for women undergoing surgery such as hysterectomy, including postoperative wound care instructions
  - Establish s system that delineates responsibility for the surgical team
  - Establish standards for temperature regulation: patient normothermia, operation room
  - Standardize the selection and timing of prophylactic antibiotics
  - Standardize the timing of discontinuation of prophylactic antibiotics
  - Establish standard on skin preparation,
- Recognition and prevention
  - Asses patient risk preoperatively for SSI: Blood glucose level, BMI, immunodeficiency, methicillin-resistant Staphylococcus aureus status, Nutritional status, smoking status.
- Response
  - Develop intraoperative "Timeouts" to address antibiotic dosage, timing, prophylaxis issues, and patient-specific issues
  - Reassess patient risk for SSI based on length of surgery, potential bowel incision, vaginal contamination and amount of blood loss
  - Provide postoperative care instructions and education to women undergoing major gynecologic surgery (hysterectomy) and family members
- Reporting and systems learning
  - Establish a culture of huddles for high risk patients
  - Create system to analyze and report surgical site infection data

- Monitor outcomes and process metrics
- Actively collect and share physician-specific surgical site infection data with all surgeons as part of their ongoing professional practice evaluation
- Standardize a process to actively monitor and collect surgical site infection data with postdischarge follow-up

3) The SSI bundled intervention after major gynecologic cancer surgery 4.

- Preoperative processes
  - "Preventing surgical site infection" pamphlet for patient education
  - 4% chlorhexidine gluconate shower night before and day of surgery
  - Chlorhexidine cloths at morning admission
- Intraoperative processes
  - Surgical care improvement project compliance with antibiotic administration
  - Complete coverage of incisional area with 2% chlorhexidine gluconate and 70% isopropyl alcohol solution
  - Redose of cefazolin within 3-4 hours after incision
  - Sterile closing tray for fascia and skin closure
  - Staff glove change before fascia closure; gown change if soiled
- Postoperative processes
  - Practice good hand hygiene
  - Hand-cleansing agent readily available
  - Ensure dressing removal within 24-48 hours
  - Patients shower with 4% chlorhexidine gluconate after dressing removal
  - Patients education on wound care and infection symptoms
- Postdismissal processes

- Dismiss patient within 4-oz battle of 4% chlorhexidine gluconate
- Follow-up phone call from nurses within 24-72hours

6. Conclusion

The prevention of SSI represents a significant reduction of postoperative morbidity for gynecologic surgery patients. Despite the preoperative risk factors such as obesity, previous surgery, ability to pursue a minimally invasive approach may not be within the surgeon's control, evidence-based SSI prevention bundles can limit the SSIs.

Evidence based interventions include the timely administration of appropriate selected prophylactic antibiotics, use of a chlorhexidine-alcohol based prep, use of suture for skin closure, and maintenance of glycemic control in the postoperative period.

References

1. Schneid-Kofman N, Sheiner E, Holcberg G. Risk factors for wound infection following cesarean deliveries. Int J Gynecol Oncol 2005;90(1):10-15
2. Hsu CD, Cohn I, Caban R. Reduction and sustainability of cesarean section surgical site infection: An evidence-based, innovative, and multidisciplinary quality improvement intervention bundle program. Am J Infect Control 2016 Nov 1;44(11):1315-1320
3. Pellegrini, JE; Toledo, P; Soper, DE; Bradford WC; Cruz, DA; Levy, BS; Lemieux, LA. Consensus Bundle on Prevention of Surgical Site Infections After Major Gynecologic Surgery. Obstetrics & Gynecology: January 2017 - Volume 129 - Issue 1 - p 50-61

4. Johnson, MP; Kim, SJ; Langstraat, CL; Jain, S; Habermann, E; Wentink, J; Grubbs, PL; Nehring, SA; Weaver, AL; McGree, ME; Cima, RR; Dowdy, SC; Bakkum-Gamez, JN, Using Bundled Interventions to Reduce Surgical Site Infection After Major Gynecologic Cancer Surgery. Obstetrics & Gynecology: June 2016 - Volume 127 - Issue 6 - p 1135-1144

MEMO

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EDUCATION

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2018~	서울대학교병원 흉부외과 조교수

흉부외과

최재웅 서울의대

Surgical site infection after cardiac surgery

✓ SSI after cardiac procedure

- Incidence : 1% - 4%
- Increase morbidity and mortality
- Decrease long-term life expectancy
- Increase hospital cost : US$ 62,000

✓ Coronary artery bypass grafting : Use of IMA

→ 0.35 to 8.49 (donor site), 0.23 to 5.67 (chest site)

Surgical site infection after cardiac surgery

✓ Risk factors for SSI

: diabetes, hyperglycemia, peripheral vascular disease, chronic obstructive pulmonary disease, obesity (BMI of >30 kg/m2), heart failure, advanced age, involvement of internal mammary artery, reoperation, long duration of surgery, and S. aureus nasal colonization

MEMO

Current guidelines – 2013 ASHP REPORT

ASHP REPORT

Clinical practice guidelines for antimicrobial prophylaxis in surgery

Dale W. Bratzler, E. Patchen Dellinger, Keith M. Olsen, Trish M. Perl, Paul G. Auwaerter, Maureen K. Bolon, Douglas N. Fish, Lena M. Napolitano, Robert G. Sawyer, Douglas Slain, James P. Steinberg, and Robert A. Weinstein

Am J Health-Syst Pharm. 2013; 70:195-283

✓ Organisms

- Gram-positive (2/3) : S. aureus, coagulase-negative staphylococcus, and, rarely, Propionibacterium acnes.
- Gram-negative (1/3) : Enterobacter species, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, and Acinetobacter species

Current guidelines – 2013 ASHP REPORT

✓ Choic of agent : Cephalosporins (1st generation– cefazoline or 2nd generation – cefamandole and cefuroxime)

- Meta-analysis: Cephalosporins vs glycopetides (vancomycin) glycopetide – higher frequency of SSI of gram-positive SSI lower frequency of SSI caused by resistant G(+) pathogens

  → The routine use of vancomycin is not recommended
- Dose : common dose (no increase because of CPB)
- Duration : less than 24 hours

Current guidelines – 2013 ASHP REPORT

✓ Intranasal mupirocin : 45% reduction in S.aureus SSI among patients known to be colonized with S. aureus

✓ Topical administration : gentamicin or vancomycine to the sternum

→ The safety and efficacy of topical antimicrobials have not been clearly established and therefore cannot be recommended for routine use in cardiac procedure.

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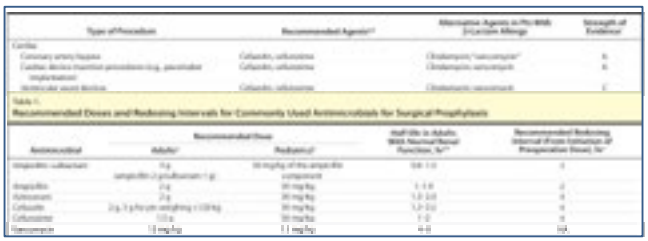
Current guidelines – 2013 ASHP REPORT

✓ Recommendations



- Single preincision dose of cefazolin or cefuroxime with intraoperative redosing.
- Vancomycin–should be used in patients known to be colonized with MRSA.
- Mupirocin–should be given intranasally to all patients with S. aureus colonization.

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Preoperative prevention

1. All cardiac surgery patients should have nasal swabs or polymerase chain reaction (PCR) testing, if available, before surgery

Class I Recommendation; Level of Evidence = A

2. Nasal disinfectants: Routine mupirocin administration is recommended for all cardiac surgery procedures in the absence of PCR testing or nasal cultures positive for staphylococcal colonization.

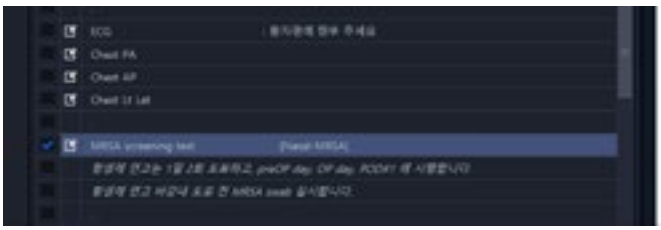
Class I Recommendation; Level of Evidence = A

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

Reality



MEMO

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Preoperative prevention

3. Presurgical bathing with chlorhexidine may be helpful in reducing skin bacterial counts.

Class IIb Recommendation; Level of Evidence = B

Reality

Self bathing using chlorhexidine after shaving on perineal and axillary area

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Preoperative prevention

4. Preoperative hypoalbuminemia is associated with an increased risk for sternal wound infections and should be corrected before surgery if possible.

Class I Recommendation; Level of Evidence = B

Reality

Preoperative target albumin > 3.0

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Preoperative prevention

5. Optimizing glycemic control is recommended in patients with increased HbA1c levels (>7.5) and serum glucose levels>200 mg/dL before any cardiac surgery procedure.

Class I Recommendation; Level of Evidence = B

Reality

Endocrinology consult, DM -> Alberti regimen from midnight

MEMO

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Preoperative prevention

6. Smoking cessation and aggressive pulmonary toilet should be performed in patients who are active smokers and those with chronic obstructive pulmonary disease.

Class I Recommendation; Level of Evidence = B

→ Smoking: independent risk factor for sternal and mediastinal infections, smoking cessation for at least 30 days

Reality

Smoking cessation more than 2 weeks

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

✓ Preoperative prevention (antibiotics)

7. A cephalosporin, either cefazolin or cefuroxime, should be given intravenously within 60 minutes before the skin incision and be continued for no longer than 48 hours.

Class I Recommendation; Level of Evidence = A

8. Vancomycin is reserved for patients with a history of type 1 allergic reactions to b-lactam agents or in cases where MRSA is a special concern.

Class IIa Recommendation; Level of Evidence = B

9. Vancomycin is not recommended as the sole prophylactic antibiotic for cardiac surgery procedures.

Class III Recommendation; Level of Evidence = B

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

Reality

: Cardiac surgery without prostheses implantation (e.g. CABG, ASD closure)

→ Cefuroxime for 36hr - 48hr

: Cardiac surgery with prosthese implantation (e.g. mechanical or tissue valve, prosthetic graft)

→ Vancomycin for 36hr - 48hr

MEMO

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Intraoperative prevention

1. Topical antibiotics should be applied to the cut edges of the sternum on opening and before closing all cardiac surgical procedures involving a sternotomy.

Class I Recommendation; Level of Evidence = B

2. Bone wax is not recommended for application to the cut edges of the sternum.

Class III Recommendation; Level of Evidence = B

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

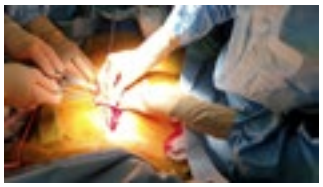
Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

Reality

: Vancomycin paste (2g + 2ml normal saline) apply after opening of sternum

: Water-soluble bone wax



EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Intraoperative prevention

3. Closing the sternum with a figure-of-eight technique may be preferable to prevent sternal dehiscence and wound infections, particularly in high-risk patients.

Class IIb Recommendation; Level of Evidence = B

4. Rigid sternal fixation with bands or plates may reduce sternal dehiscence and wound infections.

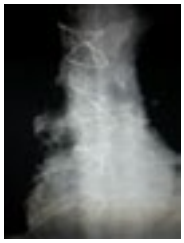
Class IIb Recommendation; Level of Evidence = B

MEMO

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72



Reality

→ Simple wire technique (surgeon's preference)

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Intraoperative prevention

5. Continuous insulin infusion should be initiated tomaintain

serum glucose level<180 mg/dL.

Class IIb Recommendation; Level of Evidence = B

Reality

→ Strict control on immediate postoperative period (ICU)

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Intraoperative prevention

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Class IIb Recommendation; Level of Evidence = B

Reality

→ Strict control on immediate postoperative period (ICU)

MEMO

EXPERT CONSENSUS REVIEW: PERIOPERATIVE MANAGEMENT

Prevention and management of sternal wound infections

Harold L. Lazar et al. J Thorac Cardiovasc Surg 2016;152:962–72

✓ Postoperative prevention

1. External chest support vests may limit the incidence of sternal dehiscence and infections.

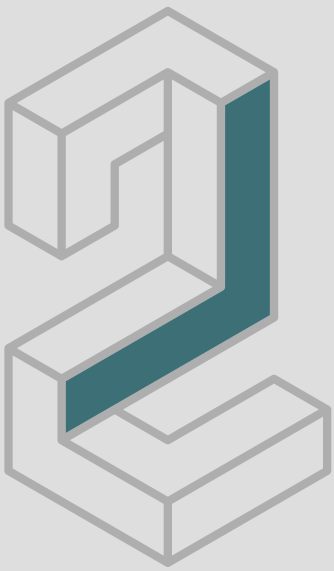
Class IIb Recommendation; Level of Evidence = B

Reality

MEMO

SESSION II.
정책세션

강중구 차의과학대학



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2016~2017	서울대학교병원 가정의학과 전임의
2017~2020	질병관리본부 보건연구관 재직(의료감염관리과)
2020~	질병관리청 보건연구관 재직(의료감염관리과)

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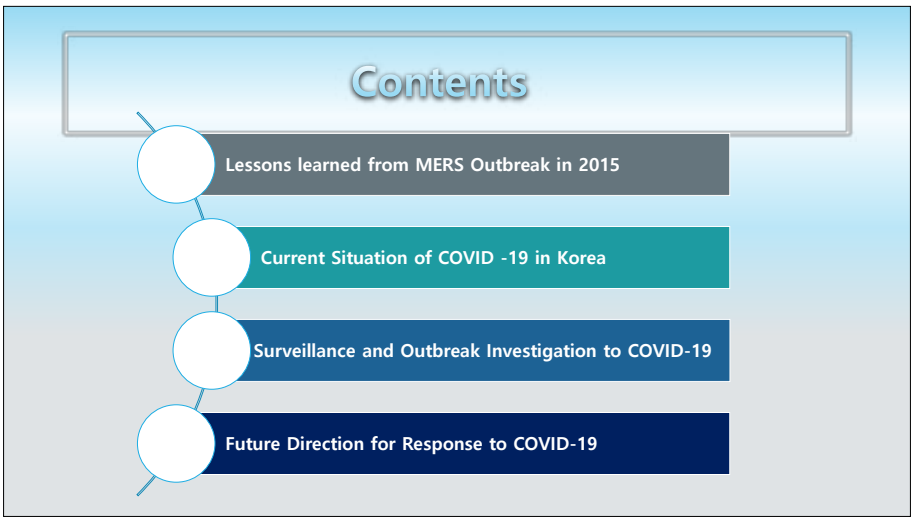
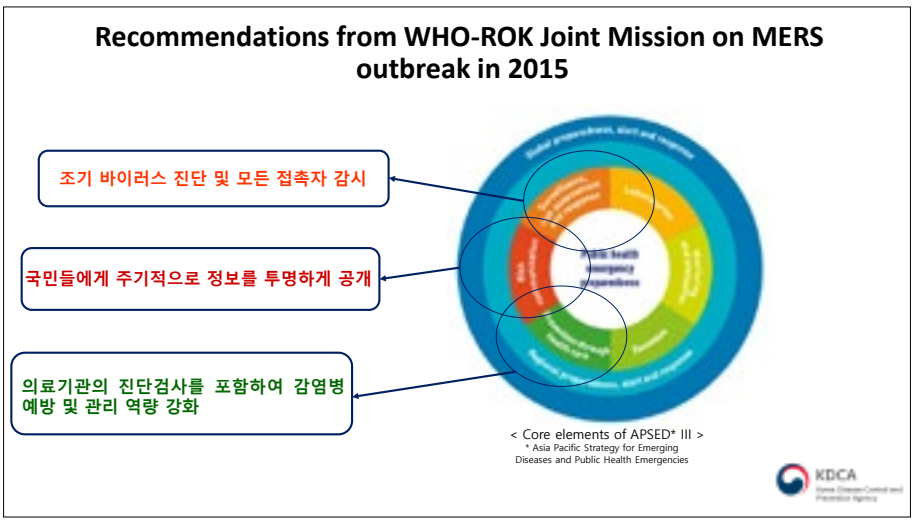
박현정 질병관리청 의료감염관리과

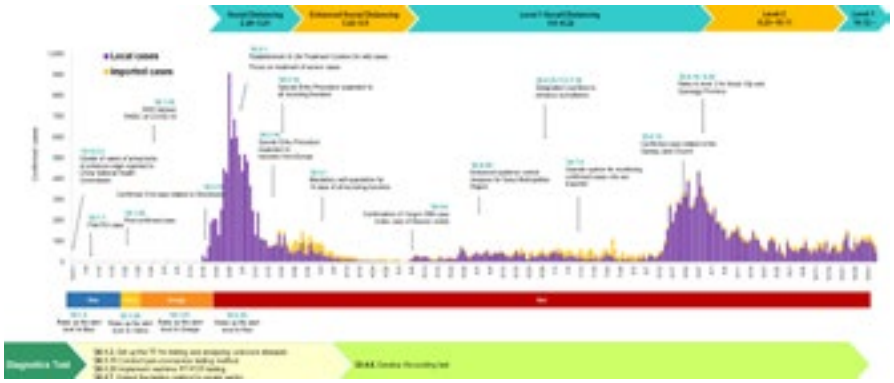




Build up Infrastructure after MERS Outbreak in 2015

KDCA

Progress of COVID-19 Outbreak



Progress of COVID-19 Response

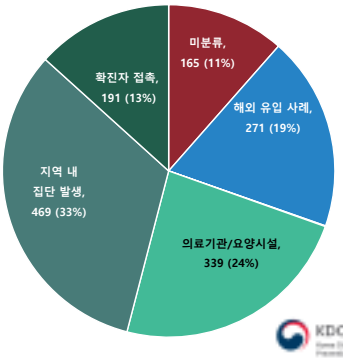
구분	제1기 (1.20.~2.17.)	제2기 (2.18.~5.5.)	제3기 (5.6.~8.11.)	제4기 (8.12.~10.11.)	제5기 (10.12.~ current)
	해외 유입 사례별 발생	대규모 집단발생과 강력한 사회적 거리두기	소규모 집단 산발적 발생	소~중간규모 집단 다수 발생	소규모 집단 발생
확진자수	30명	10,774명	3,856명	5,789명	608명
해외유입비율	56.7% (17명/30명)	10.1% (1,085명/10,774명)	31.5% (903명/2,868명)	4.8%(277명/5,789명)	36.5%(222명/608명)
사망자* (치명률)	1명 (3.3%)	275명 (2.6%)	33명 (0.9%)	19명 (0.3%)	18명 (2.9%)
바이러스	▪ S,V형 위주	▪ S,V형 위주 ▪ GH 그룹 일부 출현	▪ GH 그룹 위주 ▪ S,V형 감소	▪ GH 그룹 위주	▪ 분석중
유행 특성	▪ 중국 등 해외입국자 위주로 개인 단위의 산발 발생	▪ 신천지 대구 교회 관련 대규모 발생, 여성과 젊은 층 비율 높음	▪ 이태원 클럽 등 집단시설에서 종교시설, 소모임 등으로 발생 양상 변화, 남성 및 중장년 층 비율 증가	▪ 대규모 집회, 종교시설, 다중이용시설 중심으로 발생 급증, 위중·중증 환자 증가	▪ 요양시설, 재활병원 등 고위험시설에서의 집단 발생
전략	▪ 고위험 지역으로부터의 입국 차단	▪ 강화된 사회적 거리두기 ▪ (04.01~) 모든 해외입국자 14일간 자가격리	▪ 사회적 거리두기 ▪ 생활속 거리두기 시행 ▪ 3T* 전략 유지	▪ 강화된 사회적 거리두기 ▪ 3T* 전략 유지	▪ 완화된 사회적 거리두기 ▪ (10.13~) 공공장소 마스크 착용 의무화

* 3T : Testing, Tracing, Treating Strategy

Current status (As of 21 Oct)

- 총 확진자 수 : 25,424
- 총 사망자 수 : 450
- 치명률 : 1.77%

감염 경로에 따른 사례 분류 (10.19. ~ 11.1.)



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COVID-19 Response Strategy

Goal : Suppression of Health and Economic Damage

역학적 관점	사회적 관점	의학적 관점
• 모든 해외입국자 검사 • 해외입국자의 14일간 자가격리	• 사회적 거리두기 • 생활속 거리두기 캠페인	• 환자 특성에 따른 치료, 일반 대중의 안전한 의료 서비스 이용
• **국내 전략** - 3T (진단(Test), 추적(Trace), 치료(Treat)) - 조기 진단과 역학조사를 통한 확산 방지	• 매일 정규 브리핑 • 대중의 행동변화 유도	• 증상에 따른 환자 분류 - 생활치료센터(경증) - 감염병 전담병원(중등도) - 중환자실(중증)

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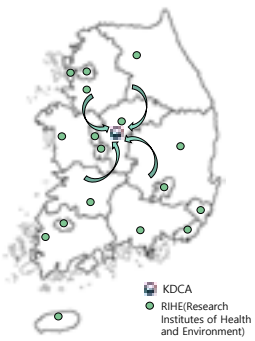
National Laboratory System establishment before COVID-19

➢ **중앙에서 지역까지 연결되는 전국적인 검사실 네트워크 구축**
- 의료기관 및 검사 수탁기관 → 256개 보건소 → **18개 보건환경연구원(RIHE)** → 질병관리청

➢ **검체 운송 시스템 구축**
- 확진 검사를 위한 검체가 24시간 내 질병관리청으로 이송

➢ **감염병 진단검사 역량 강화**
- 질병관리청은 86개 법정감염병의 진단할 수 있는 역량 갖춤
- 신종 감염병에 대한 진단 방법 개발 역량 강화

➢ **긴급승인제도(Emergency Use Authorization, EUA) 도입**
- EUA는 승인되지 않은 진단검사를 감염병 유행 시 임시로 허용할 수 있도록 함



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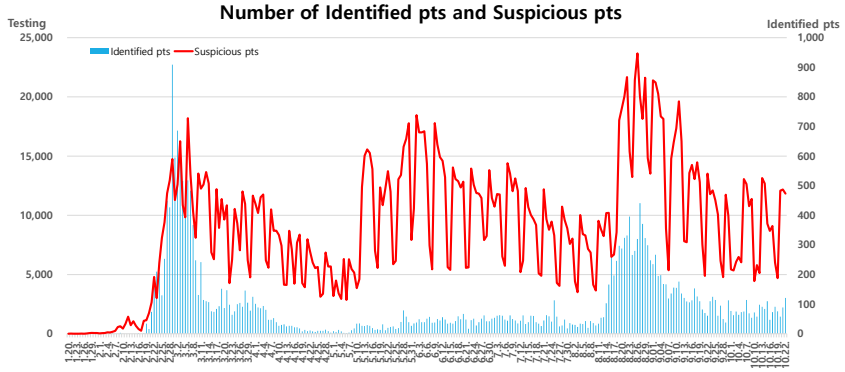
3T Strategy : Testing



(as of 23 Oct)

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3T Strategy : Testing

- 다양한 형태의 선별진료소 운영을 통해 조기 환자 발견을 위한 검사 역량을 높임

- 드라이브 스루(Drive-Thru) 선별진료소
- 워크 스루 선별진료소(Walk-Through screening Station)

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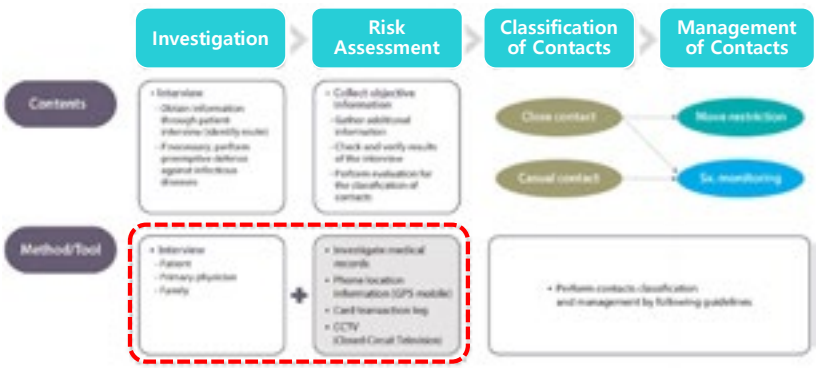
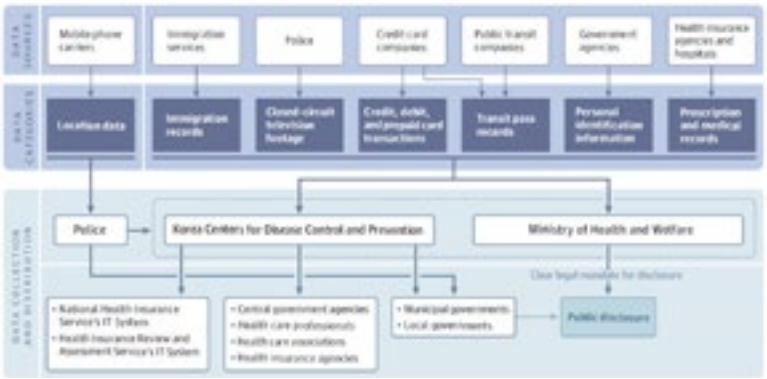
3T Strategy : Tracing



Osong Public Health Res Perspect 2020;11(1):60-63

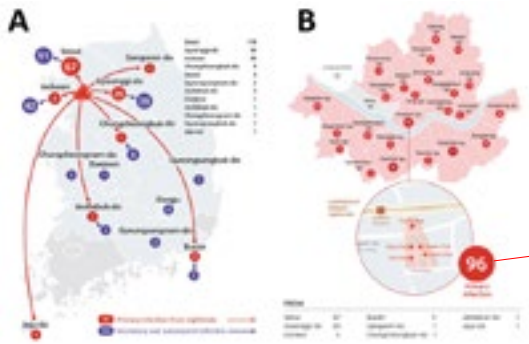
3T Strategy : Tracing

Coronavirus Disease 2019 Contact Tracing in Korea: Sources, Categories, Collection, and Distribution of Data



Park, S. at al Information Technology-Based Tracing Strategy in Response to COVID-19 in South Korea-Privacy Controversies. JAMA, 2020.

Result of cluster contact tracing of related to the COVID-19 outbreak in Itaewon nightclubs, Seoul (as of 25 May)



A) 주요 도시별 사례 분포 (n = 246)

B) 서울 지역 내 나이트클럽 관련 1차, 2차 감염사례의 분포
(n = 118, of which 96 contracted the disease in Seoul nightclubs)

- 36.0% among 246 cases
- 81.4% among in in Seoul nightclubs

Kang CR et al. Coronavirus disease exposure and spread from nightclubs, South Korea. Emerg Infect Dis. Sep 2020: Appendix Figure 2.

3T Strategy: Treatment

Treatment and care system differentiated based on severity

Early detection

- 역학조사
- 특별입국절차
- 건강 관리 앱
  (자가 진단 앱 등)

Classification of confirmed cases

- 경증(Mild)
- 중등도(Moderate)
- 중증(Severe)
- 최중증(Very severe)

Treatment and care

- 생활치료센터
- 감염병 전담병원
- 국가 지정 입원 치료기관
- (상급)종합병원 등

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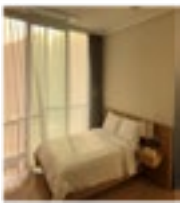
3T Strategy: Treatment
Living Treatment Centers for mild patients

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Risk Communication – Daily Briefing & Social Media




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Social distancing, distancing in daily life campaign

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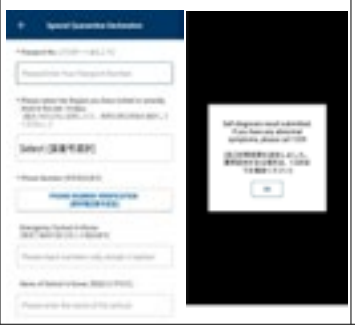
Self Health Check Mobile App

Start mobile app	Proceed with special quarantine form	Proceed with daily Self Health Check	Check screening clinics
			

Future COVID-19 Response direction : Sustainability

Goal : Harmonizing Infection Prevention Control and Economic growth

역학적 관점

- 역학조사관(EIS) **역량 강화**
  - ✓ 교육 훈련을 통한 지역 내 역학조사의 양적, 질적 향상
- **고위험군**에 대한 방역 관리
  - ✓ 고위험군 대상 선제적 검사 등

* EIS: Epidemic Intelligence Service

사회적 관점

- 사회적 거리두기 세분화(3→5)
- 획일적인 봉쇄정책을 지양하고, 정밀/타겟 방역 시행
- 정신 건강 서비스
- 소외 계층 지원 정책

의학적 관점

- 환자의 증상에 근거하여 의료기관 등 의료 자원의 효율적 배분 지향
- 중앙에서 중환자 병상 및 인력 모니터링
- 경증환자를 수용 가능한 호흡기 병원 확보

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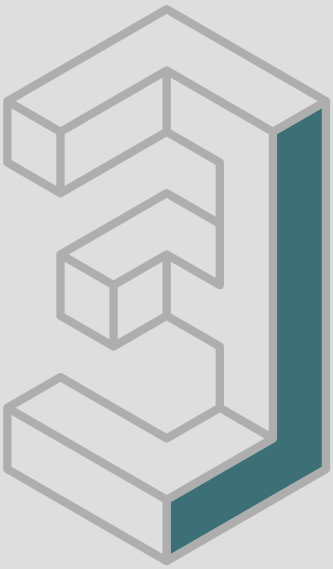
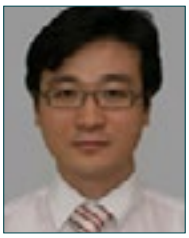
SESSION Ⅲ.

다양한 수술감염에 대한 처치

장원호 순천향의대, **김한구** 중앙의대





한 성 록 인제의대

EDUCATION

1990~1996	학사, 인하대학교 의과대학 졸업
1997~2000	석사, 인하대학교 대학원 의학과
2008~2014	박사, 연세대학교 대학원 의학과

CAREER

1996~1997	인하대학교병원 인턴
1997~2001	인하대학교병원 신경외과 전공의
2012~2013	Neural Engineering Laboratory, Mayo Clinic, Rochester, Minnesota, USA
2016~	인제대학교 일산백병원 교수

신경외과 (개두술) 수술 후 감염과 적절한 처치

한 성 록 인제의대

1. Category of infection after Craniotomy (개두술)

ㄱ. Superficial incisional infections (60%) limited to the skin and subcutaneous tissue.
ㄴ. Deep incisional infections may involve the subgaleal space and bone flap.
ㄷ. Deep organ space infections include subdural empyema/brain abscess (14%), and meningitis/ventriculitis (22%).
ㄹ. Post-craniotomy infection rates ranging from 0.8% to 10%. (S. aureus m/c)
ㅁ. Cranioplasty and bone flap replacement procedures -〉 Infectious complications rates approaching 30%.

2. Risk Factors for Post-operative Infection

ㄱ. Postoperative CSF(뇌척수액) leakage and early subsequent reoperation
ㄴ. Surgery lasting longer than 4 hours
ㄷ. Emergency surgery
ㄹ. Clean-contaminated and contaminated surgery
ㅁ. Neurosurgical intervention in the preceding month.
ㅂ. Synthetic dural (경막) substitutes

3. Preventive Strategies

ㄱ. Administration within 1 hour before incision (2 hours is allowed for the administration of vancomycin and fluoroquinolones),
Antibiotics with short half-lives such as cefazolin should be re-administered every 3 to 4 hours during prolonged surgery to ensure adequate drug levels throughout the period of potential contamination, including the time of wound closure.

ㄴ. Discontinuation of the antibiotic within 24 hours after surgery is completed.

ㄷ. No evidence ->Preoperative hair removal reduces the incidence of postoperative infection
Hair removal that is performed should be done as close to the time of surgery as possible. (Clippers 〉 Razor)

ㄹ. Several antiseptic skin preparations have been used (chlorhexidine, iodophor compounds, alcohol), but no agent has been definitively shown to be more effective than another.
To provide effective antisepsis, these agents must remain on the skin until they dry naturally, with avoidance of any pooling.

ㅁ. Adhesive barrier drapes with antiseptic embedded within the adhesive may prevent bacterial contamination of the surgical site throughout the operative procedure (reduce the incidence of SSI has not been proven)

ㅂ. There is no reliable evidence to support having the patient bathe or shower preoperatively with an antiseptic skin product.

ㅅ. Both the number of health care workers within the operating room and traffic throughout the procedure should be kept to a minimum.

ㅇ. Adequate ventilation minimizes the particulates and bacteria in the perioperative environment, and the use of high-efficiency

particulate air (HEPA) filters has been shown to reduce the rate of SSI development.

4. Antibiotics

CNS predominantly by passive diffusion down a concentration gradient, with physical barriers such as **the blood-brain and blood-CSF barriers** functioning as the primary determinants of drug distribution.

Suitable empirical regimens for post-craniotomy infections typically include a combination of vancomycin and a drug such as a third- or fourth-generation cephalosporin that has antipseudomonal activity (e.g., ceftazidime, cefepime), with the addition of metronidazole when anaerobic infection is possible.

ㄱ. β-Lactam antibiotics (penicillins, cephalosporins, carbapenems)

ㄴ. Third- and fourth- generation cephalosporins (cefotaxime, ceftriaxone, ceftazidime)'

ㄷ. β --lactamase inhibitors (sulbactam and tazobactam)

ㄹ. Carbapenems (imipenem and meropenem)

ㅁ. Vancomycin

ㅂ. Linezolid and Daptomycin

ㅅ. Rifampin

ㅇ. Fluoroquinolones (levofloxacin, ciprofloxacin, moxifloxacin)

ㅈ. Aminoglycosides and Polymyxin(colistin)

5. Superficial Infections

ㄱ. 임상증상

The most common infectious complication after craniotomy.

Local erythema, swelling, and tenderness at the craniotomy site with suppurative drainage.

ㄴ. Diagnostic Imaging and Laboratory Data

CT or MRI → Fluid collections in the subgaleal (두피하) or epidural spaces (경막외)

ESR or CRP level may provide some assistance in detecting infection and monitoring the response to therapy.

수술 직후에 올라가도 감염이 없는 경우는 POD 5일째는 정상으로 내려옴

ㄷ. 치료

Antibiotic therapy

Hyperbaric oxygen therapy is sometimes used to treat complicated superficial infections, including those involving the bone flap.

6. Deep incisional infections: Subgaleal space and bone flap

ㄱ. Diagnostic Imaging and Laboratory Data

CT and MRI studies may show the presence of subgaleal or epidural infection with bone flap destruction suggestive of osteomyelitis.

Hardware failure with surrounding bone lucency may also indicate infection.

ㄴ. 치료

Antibiotics alone, débridement with replacement of the bone flap, or surgical débridement with removal of the bone flap.

7. Subdural Empyema (경막하 농양)

ㄱ. 임상증상

Occurred more than 1 month after the craniotomy (50%이상)

Seizures (25%)

ㄴ. Diagnostic Imaging and Laboratory Data

CT → A crescent-shaped fluid collection that is slightly more dense than CSF

ㄷ. 치료

Surgical drainage, Antibiotic therapy is typically 4 to 6 weeks.

8. Brain Abscess

ㄱ. 임상 증상

Signs and symptoms of postoperative abscess are frequently nonspecific.

(Fever is present in only about half of affected patients)

Intraventricular rupture of a brain abscess → Sudden neurological deterioration with obtundation or coma → Poor outcome 50% (mortality 27%)

ㄴ. Diagnostic Imaging and Laboratory Data

Diffusion-weighted MRI → a high degree of specificity and sensitivity in differentiating spontaneous abscess from other ring-enhancing lesions, and its application to the diagnosis of postoperative brain abscess may prove useful.

ㄷ. 치료

Combination of surgical drainage and a prolonged course of intravenous antibiotics is required (6 to 8 weeks)

9. Bacterial Meningitis

ㄱ. 임상 증상

Bacterial meningitis is relatively uncommon after neurosurgical procedures and complicates less than 1% of craniotomies.

Aseptic (chemical) meningitis (irritation from blood breakdown products or from factors released by surgical materials such as dural substitutes) is responsible for 60% to 75% of all cases of postoperative clinical meningitis (주로 children and after posterior fossa surgery후)

ㄴ. Diagnostic Imaging and Laboratory Data

Neuroimaging studies rarely assist in the diagnosis of postoperative meningitis (meningeal enhancement 가 80%의 감염이 없는 수술 후 환자에서 보일 수 있다.)

CSF exam and culture → "gold standard"

CSF hypoglycorrhachia and pleocytosis with neutrophilic predominance

ㄷ. 치료

The infecting pathogen has been isolated and its susceptibility profile determined, antibiotic therapy can be modified for optimal treatment.

Corticosteroids typically provide symptomatic relief in patients with aseptic chemical meningitis.

홍준화 중앙의대

EDUCATION

아주대학교 의과대학

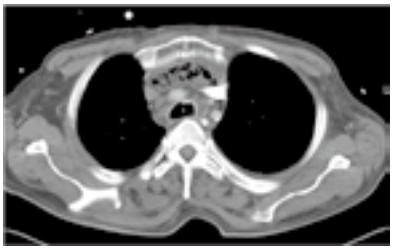
CAREER

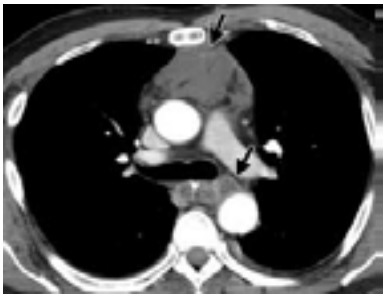
Mayo Clinic Clinical Fellow
중앙대학교 의과대학 교수, 흉부외과 과장

흉부외과 (심장수술) 수술 후 감염과 적절한 처치

홍준화 중앙의대

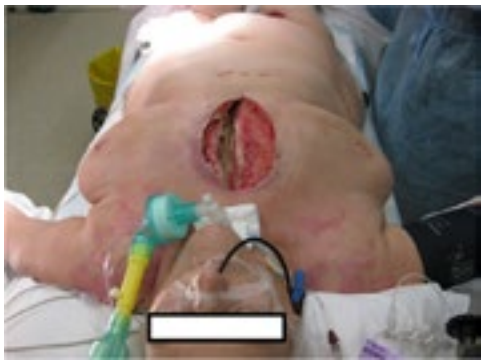
Mediastinitis





European Respiratory Review 2010

Radiographics 2011



- Deep sternal wound infection(DSWI)
- Post-sternotomy mediastinitis

Infect Drug Resist 2018

Deep sternal wound infection

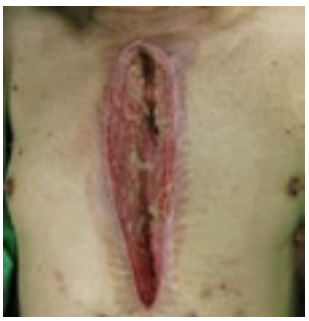
- Rare but potentially devastating complication
- The incidence between 0.2% and 3%
- Outcome impact
  - Increased 30-day and 1-year mortality rates
  - Reduced long-term survival
  - Prolonged hospital length of stay
  - Excess treatment costs

Deep sternal wound infection

- Cuases
  - Direct wound contamination
  - Contiguous extension from adjacent structures
  - Descending head and neck necrotizing infections
  - Blood-borne routes
- Range
  - subcutaneous tissue
  - Bone
  - Cartilage
  - Mediastinum - leading to the feared complication of mediastinitis
    - in-hospital mortality rate ranging from 1.1% to 19%

Unresolved mediastinitis

- Septic shock
- Catastrophic bleeding



ATS 2015

Diagnosis

- Combination of clinical, laboratory and radiological findings
- Clinical findings
  - fever
  - wound dehiscence
  - purulent wound discharge
  - Sternal instability

Classification

Sternal Wound Infection	Type	Tissue Involvement	Classification
Superficial sternal wound infection (Above fascial layer)	1	Skin and subcutaneous tissue	Superficial wound infection
Deep sternal wound infection (Below fascial layer)	2a	Retrosternal tissue and bone not involved	Deep incisional infection
	2b	Retrosternal tissue	Mediastinitis
	2c	Retrosternal tissue and bone	
	2d	Frank sepsis	

Classification

AMSTERDAM Classification of Poststernotomy Mediastinitis[1,10]

Type	Sternal Stability	Bone Viability and Stock	Reconstruction	Timing of Reconstruction
1	Stable	Minimal bone loss	Negative pressure wound therapy (Class I, Level B)	-
2a		Sufficient	Local muscle flap	Primary (Class II, Level B)
2b			Muscle or omental flap	Delayed (Class I, Level B)
3a	Unstable	Viable and sufficient	Rewiring or sternal fixation	Primary* or delayed† (Class IIb, Level B)
3b			Rewiring or sternal fixation with muscle or omental flap	
4a		Necrotic and insufficient	Muscle flap	Primary or delayed (Class IIb, Level B)
4b			Omental flap	
4c			Muscle and omental flap	

* Indicates rewiring.
† Indicates sternal fixation with plates and clips.

Microbiology

- The most common
  - coagulase-negative staphylococci (CoNS) and Staphylococcus aureus (S. aureus)
- CoNS
  - chronic obstructive pulmonary disease (COPD), obesity, and wound dehiscence
- S. aureus
  - perioperative mediastinal contamination
- gram-negative rods
  - spread from concomitant infections (for example, pneumonia or bacteremia)
  - often polymicrobial

Risk Factors

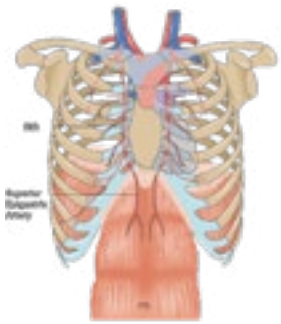
- complex and multifactorial
- no consensus has been reached
- Scoring system

Risk Factors

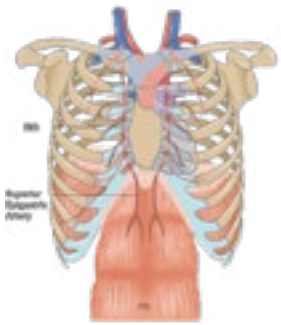
Preoperative
- Sex ?
- Age ?
- Obesity
- DM
- Smoking and COPD

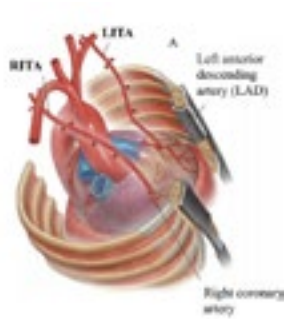
Intra & Postoperative
- Intra
  - Use of BIMA
  - Prolonged CPB
- Post
  - Re-exploration
  - Transfusion

Bilateral internal mammary arteries



Bilateral internal mammary arteries





Transfusion

- A meta-analysis(ATS 2016)
  - Almost 3-fold increase of sternal wound infection
- RCT(NEJM 2015)
  - No difference
- RBC, Plt
- Immune system

Preventive Measures

- S.Aureus nasal carriage
- Skin preparation
- Optimizing premorbid conditions
- Antibiotics prophylaxis

S.Aureus nasal carriage

- 3-fold increase of sternal infection after heart surgery
- Intranasal mupirocin
- Resistance
  - Strict use vs routine use

Skin Preparation – preop shower

- Preoperative showering or bathing with antiseptic preparations
  - Commonly used
  - No definite benefic over regular soap
- Soap by 2017 European guideline
- Chlorhexidine by 2016 American guideline

Skin Preparation

- Hair clipping
- Surgical site skin prep immediate before incision
  - Povidone-iodine
  - Chlorhexidine

Optimizing premorbid conditions

1. Correct preoperative hypoalbuminemia (defined as <3g/mL) before surgery if possible (Class I, Level B Evidence).
2. Treat all sources of extra-thoracic infections before cardiac surgery if procedure can be safely delayed (Class I, Level C Evidence).
3. Optimize serum glucose concentrations <180 mg/dL (<10 mmol/L) in patients with poor glycemic control (defined as hemoglobin A1c levels >7.5% or serum glucose concentrations >200 mg/dL [>11.1mmol/L]) (Class I, Level B Evidence).
4. Smoking cessation and aggressive chest physiotherapy in patients with COPD or who are actively smoking (Class I, Level B Evidence).

Antibiotic Prophylaxis

- Instrumental
- 5-fold reduction in sternal wound infection

Perioperative Antibiotic Selection in Cardiac Surgery[4,47,54]

Penicillin/Beta-lactam Allergy	No Penicillin/Beta-lactam Allergy		Reference
	Low risk of MRSA colonization	Proven or Suspected MRSA colonization	
Vancomycin ± gram-negative coverage	Beta-lactam antibiotic (either cefazolin or cefuroxime)	Beta-lactam antibiotic + glycopeptide (vancomycin)	2007 STS guidelines[46]
Vancomycin + gram-negative coverage		Beta-lactam antibiotic + vancomycin	2016 AATS guidelines[47]
Vancomycin + gram-negative coverage		Vancomycin + gram-negative coverage	2017 EACTS guidelines[54]

Abbreviations: AATS, American Association for Thoracic Surgery; EACTS, European Association for Cardiothoracic Surgery; MRSA, methicillin-resistant Staphylococcus aureus; STS, Society of Thoracic Surgeons.

Antibiotic Prophylaxis

- Topical use
  - vancomycin or gentamycin
  - AATS recommendation (class I, level B evidence)
- Direct sternal administration

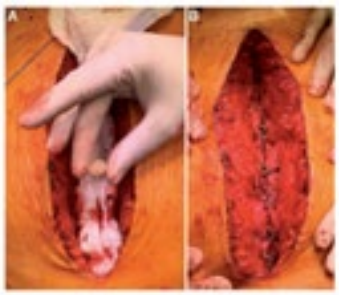


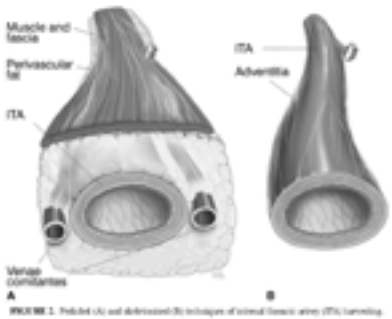
Figure 3. Vessel closure protocol. Caption: [A] Application of vancomycin powder [B] recommendation for sternal suturing.

DM control

- <180 mg/dL
- Continuous insulin infusion during the perioperative period
  - Both AATS and EACTS strongly recommend
  - Class I, level B evidence

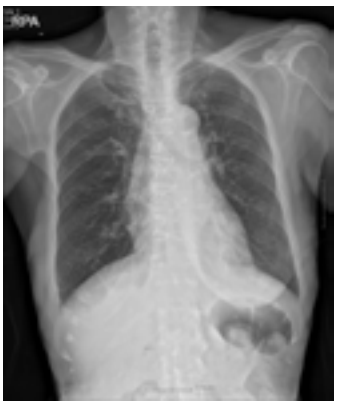
Surgical technique

- Bilateral internal mammary
  - Skeletonized technique



Surgical technique

- Prevention of sternal instability and dehiscence
  - Figure of eight
  - Robicsek



Surgical technique

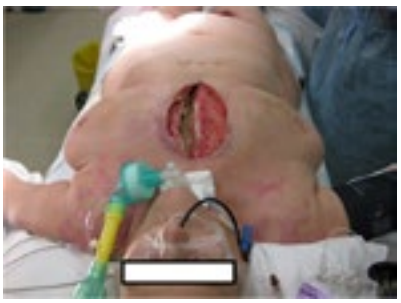
- Prevention of sternal instability and dehiscence
  - Figure of eight
  - Robicsek

Management

- Antimicrobial treatment
- Surgical management

Surgical Management

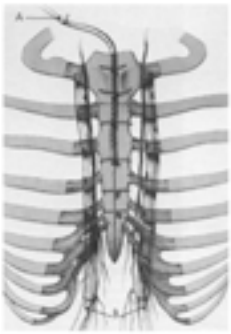
- Aggressive surgical debriment
- Open dressing
  - Right ventricular laceration
  - Prolonged immobilization for mechanical ventilation



Infect Drug Resist 2018

Surgical Management

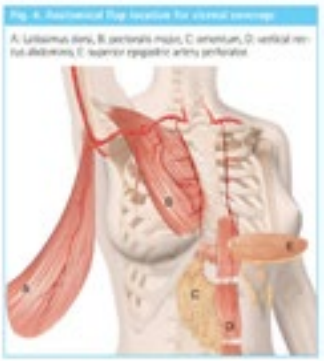
- Aggressive surgical debriment
- Open dressing
  - Right ventricular laceration
  - Prolonged immobilization for mechanical ventilation
- Closed irrigation



JTCVS 1976

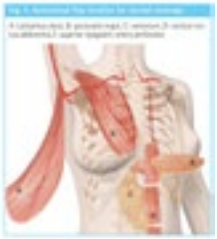
Surgical Management

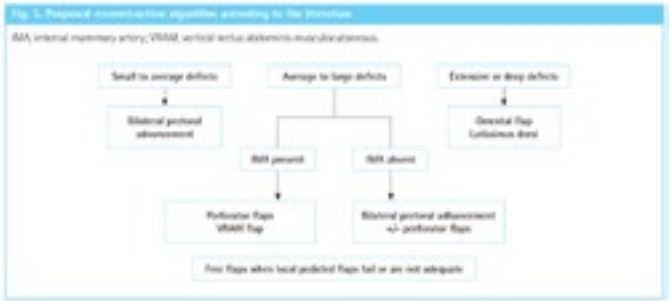
- Aggressive surgical debriment
- Open dressing
  - Right ventricular laceration
  - Prolonged immobilization for mechanical ventilation
- Closed irrigation
- Primary or delayed closure with vascularized soft tissue flap



APS 2019

Surgical Management - flap

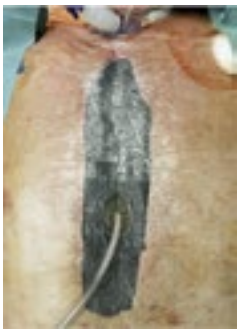




APS 2019

Surgical Management - NPWT

Surgical Management - NPWT



JTCVS 2002

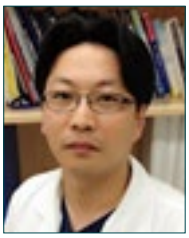
Surgical Management - NPWT

- Mechanisms
  - Removing excess fluid and tissue debris removal
  - Increasing wound perfusion
  - Promoting the growth of granulation tissue
- Advantages
  - Sternum stabilization
  - Early mobilization
- Class I, level B
  - Reduction in mortality and reinfection
  - Decrease in hospital stay

Conclusion

- Rare but devastating complication
- Identifying patients with high risk and preventive measures are important
- No significant decrease over the last decades
- More attention and refining treatment protocols

MEMO



최 훈 고려의대

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비뇨의학과
수술 후 감염과 적절한 처치

최 훈 고려의대

Introduction

- Infection is a common but avoidable complication of any surgical procedure
- Surgical site infections (SSIs) and postoperative UTI : most common cause of patient morbidity

Preventing surgical infections

- Antibiotic prophylaxis
- Non antibiotic measures-evidence based
  - bowel preparation
  - Preoperative hair removal
  - Antiseptic bathing
  - Double gloving
  - Hand-washing
  - Sterile preparation of the operative field

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AUA guideline: Principles of surgical antimicrobial prophylaxis

- Surgical hand scrubbing: scrubbing with an alcohol solution: comparable to traditional scrubbing
- Sterile preparation of the op field : the cornerstone
- Surgical technique play an important role in preventing SSIs.
  - Gentle tissue handling
  - Maintaining vascularity
  - Avoiding hematomas or other unperfused spaces
  - Minimizing operative time

General recommendations for perioperative managements

- Hair removal
  - preoperative hair removal should be avoided
  - but if necessary hair should be removed immediately before an operation.
  - Both clipping and depilatory creams resulted in fewer SSI than shaving with a razor
  - preferable to use clippers rather than a razor.

General recommendations for perioperative managements

- Hypothermia
  - Morbid myocardial events
  - Increased blood loss and the requirement for transfusion
  - postsurgical wound infections
  - prolonged hospitalization.

MEMO

General recommendations for perioperative managements

- Hypothermia
  - delay healing and predispose patients to SSI, suggesting that perioperative normothermia should be maintained unless therapeutic hypothermia is specificall indicated

General recommendations for perioperative managements

- supplemental perioperative oxygen
  - significantly reduces postoperative nausea and vomiting
  - diminishes the decrease in phagocytosis and bacterial killing usually associated with anesthesia and surgery
  - reduces the rate of postoperative wound infection among patients improve surgical outcome with little or no associated risk.

Risk factors

- Patient risk factors :
  - advanced age
  - malnutrition, diabetes, smoking, obesity
  - infections in nonsurgical sites
  - immunocompromized status,
  - long preoperative hospital stay

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Risk factors

- Environmental risk factors :
  - Inappropriate skin preparation
  - preoperative hair removal, prolonged operation time
  - Inappropriate AMP
  - poorly controlled operating room ventilation system
  - Inadequate sterilization of surgical instruments
  - foreign body use in operation
  - Inappropriate drain use
  - Immature surgical techniques.

Risk factors – age

- age and the risk of SSI remains unclear
- 144 485 surgical procedures reported that an increase in risk was noted until the age of 65 years, whereas the risk for SSI decreased after this age

Antibiotic prophylaxis

- Reducing SSI, UTI : well established facts
- Minimize the effect on the patients normal bacterial flora
- Minimize adverse effects of antibiotics
- Minimize the emergence of antibiotics resistant strains
- Cost effectiveness

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Antibiotic prophylaxis

- It is well known that antimicrobial agents should be administered 30 min before the operation
  - bactericidal concentration of drugs is established in serum and tissue by the time an incision is made
- Additional doses should be given every 3–4 h during the procedure to maintain therapeutic levels for a few hours after the incision is closed.

Antibiotic prophylaxis

- SSI rate
  - 0.6% who received AMP preoperatively,
  - 1.4% perioperatively during 3 h after an incision
  - 3.6% postoperatively : more than 3 but less than 24 h after an incision

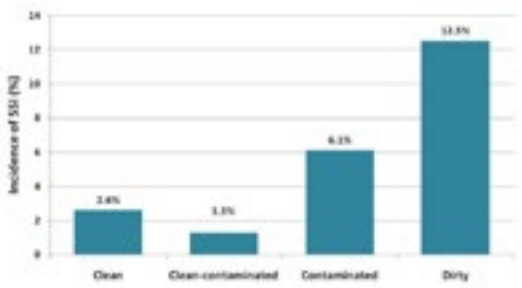
Surgical wound classification

Clean	• Uninfected wound without inflammation or entry into the genital, urinary, or alimentary tract • Primary wound closure closed drainage
Clean contaminated	• Uninfected wound with controlled entry into the genital, urinary, or alimentary tract • Primary wound closure closed drainage
Contaminated	• Uninfected wound with major break in sterile technique (gross spillage from gastrointestinal tract or nonpurulent inflammation) • Open fresh accidental wounds
Dirty infected	•Wound with preexisting clinical infectionor perforated viscera •Old traumatic wounds with devitalized tissue

MEMO

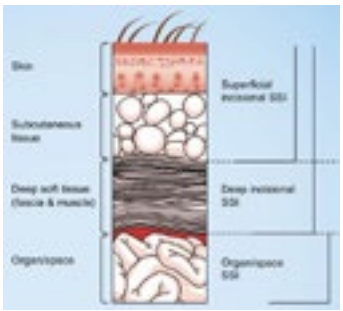
Incidence of SSI

by Category of Wound Contamination



Surgical site infections

- **Surgical site infection (SSI) is a type of hospital acquired infection following surgery, related to the surgical site**



Occurs within 30days after operation

Incidence of SSI

by Category of Wound Contamination

Table 1 Wound classification of urologic surgery[4,7]

Wound classification	Procedures
Clean	Nephrectomy, adrenalectomy, retroperitoneal tumor dissection, lymph node dissection, etc.
Clean-contaminated	Nephroureterectomy, partial nephrectomy, pyeloplasty, total cystectomy without bowel segments, partial cystectomy, operations for vesicoureteral reflux, radical prostatectomy, genital surgery, etc.
Contaminated (using bowel segments)	Neobladder, continent pouches, bladder augmentation, ureteral replacement, etc.
Dirty	Open trauma of urinary tract, operation for infected kidney, etc.

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비뇨의학과 opertaion

- Kidney & Ureter
  - 1. Aspiration & sclerotherapy 경피적 신장 물혹 흡입 및 경화요법
  - 2. Renal anglo or PCN 경피적 신장 요로 전환술
  - 3. URS 요관경하 요관 제석술
  - 4. PNL 경피적 신석 제석술
  - 5. Open ureterolithotomy (개복적) 요관 절석술
  - 6. simple nephrectomy (Donor nephrectomy 포함)
  - 7. Radical nephrectomy. 근치적 신장적출술

비뇨의학과 opertaion

- Bladder
  - 1. TURB 경요도적 방광 절제술
  - 2. Radical cystectomy (Bowel Preparation 필요)
  - 3. Anti-reflux OP 항 역류술 (역류 교정술)
  - 4. PNL 경피적 신석 제석술
  - 5. Hydrodistension 방광확장술

비뇨의학과 opertaion

- Prostate
  - 1. TR Bx 초음파하 경직장 전립선 조직생검
  - 2. TURP 경요도적 전립선 절제술
  - 3. Open prostatectomy 개복적 전립선 적출술
  - 4. Radical prostatectomy 근치적 전립선 적출술

MEMO

비뇨의학과 opertaion

- **Scrotum & Testis**
  - 1. visual urethrotomy. 요도경하 요도내 절개
  - 2. Orchiopexy 고환 고정술
  - 3. Varicocelectomy 정계정맥류 제거술
  - 4. Hypospadias repair 요도하열 교정술
  - 5. Vasellinoma Removal & Skin Graft, Penoplasty
    바셀린종제거술과 피부이식술, 음경성형술
  - 6. Vasovasostomy 정관 문합술
  - 7. Penile prosthesis 음경보형물삽입술

비뇨의학과 opertaion

- **Female Urology**
  - 1. TVT, Cystocele repair 경질적 테이프 교정법, 방광루 교정술
  - 2. Sling OP, Vesicovaginal Fistula 슬링수술 ,방광질루 교정술

외래 procedure	외래수술
ESWL (Extracorporeal Shockwave Lithotripsy)	Suprapubic Cystostomy
Cystoscopy	Testicular Biopsy
Urethral dilatation	Sperm Extraction
UDS (UroDynamicStudy)	Circumcision
	Vasectomy

AUA Recommendations

- **Open/ laparoscopic surgery without entering urinary tract**
  - (prophylaxis indicated if risk factors)
  - Level of evidence: Ib, III, IV
  - Single dose of iv cephalosporin vs no prophylaxis : significantly lower overall infection rate (8% vs 27%)
  - In a prospective but nonrandomized comparison of 424 hand-assisted laparoscopic nephrectomies with and without antimicrobial prophylaxis (cephalosporin) : wound infections occurred significantly more often in patients without prophylaxis (13% vs 5.4%)

MEMO

AUA Recommendations

- Open/ laparoscopic surgery without entering urinary tract (prophylaxis indicated if risk factors)
- Level of evidence: Ib, III, IV
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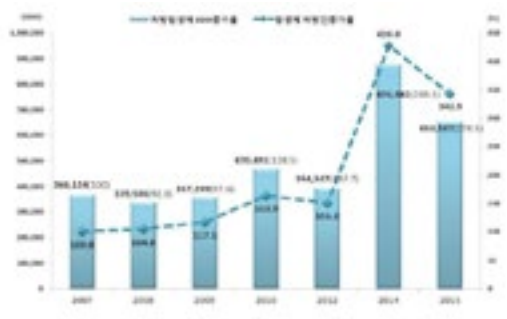
- In a prospective but nonrandomized comparison of 424 hand-assisted laparoscopic nephrectomies with and without antimicrobial prophylaxis (cephalosporin) : wound infections occurred significantly more often in patients without prophylaxis (13% vs 5.4%)

AUA Recommendations

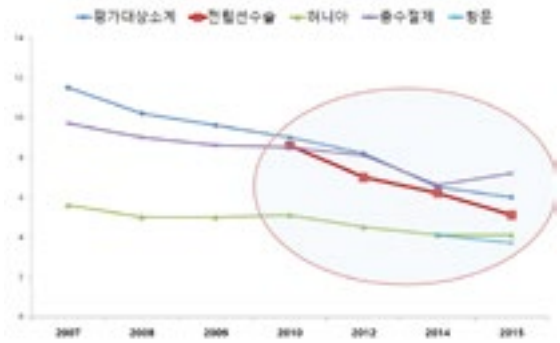
- Open/ laparoscopic surgery involving intestine
  - (prophylaxis indicated in all patients)
- Level of evidence: Ia, IV
- RCTs for urologic surgery involving bowel (primarily urinary diversion, with or without cystectomy) have not been reported
- meta-analyses of percutaneous endoscopic gastrostomy, appendectomy, and colorectal surgery confirm benefit to antimicrobial prophylaxis in the setting of surgery involving intestinal components

연도별
평가 대상수술의 연간 항생제 처방 건 증가율



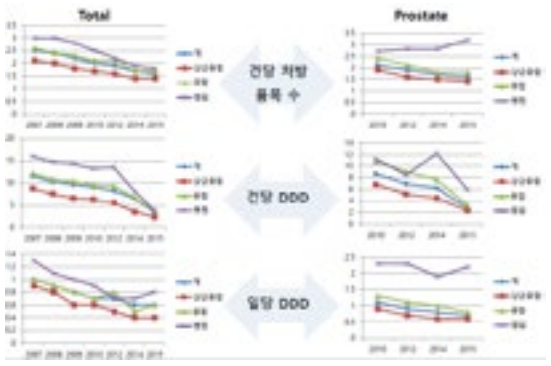
MEMO

연도별 건당 일일상용량



피부절개 전 1 시간 이내 항생제 투여

연도별 요양기관 종별 건당 처방 품목수



MEMO

예방적 항생제 총 평균 투여일수

[원내+퇴원]

예방적 항생제 총 평균 투여일수

[원내+퇴원 (일)]

수술 후 감염 의심증상 발생

2014년도

- 전립선
- 전체 : 1,839 명
- 감염의심 26 (1.4%)
- 수술부위감염 20 (1.1%)
- 수술관련감염 13 (0.7%)

2015년도

- 전립선
- 전체 : 883 명
- 감염의심 14 (1.6%)
- 수술부위감염 6 (0.7%)
- 수술관련감염 8 (0.9%)

MEMO

Conclusion

- Most of cases, catheter may need to be held.
  - guidelines for preventive antibiotics considering urinary tract infections must be presented
- Infective parameters are constantly improving
  - to induce the proper use of prophylactic antibiotics in surgery
  - to prevent antibiotic resistance and reduce surgical site infection.
  - Systematic management is necessary

MEMO

이정은 가천의대

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서울대학교병원 정형외과 전임의
연세대학교 원주세브란스기독병원 임상조교수
가천의대 길병원 정형외과 조교수

정형외과 수술 후 감염과 적절한 처치

이정은 가천의대

Prevalence of SSI (Surgical site infections)

- 1.9% of all surgical procedures
  (2006-2009, in the USA)
- 2.0 – 9.7% in Korea (1995-2010)
  Kil Yeon Lee, et al. J Korean Surg Soc (2011)
- For all orthopedic procedures: 0.6 - 2.55%
  K. Keely Boyle, et al. Curr Rev Musculoskelet Med (2018)

SSI for orthopedic surgery

- Hand surgery: < 1%
- Joint arthroplasty:
  - Total joint arthroplasty(1.31%)
  - Revision hip arthroplasty(1.94%)
  - Revision total knee arthroplasty(4.57%)
- Joint Arthroscopy: 0.04% to 0.42%
- Foot and Ankle : 6.5%
- Orthopedic Oncology: 10.1%

Joseph Letzelter et al. J Am Acad Orthop Surg (2019)

MEMO

SSI for orthopedic surgery

Type of orthopaedic surgery	Risk of surgical site infection
Primary hip and knee arthroplasties	0.8% Norwegian Register (73,000 arthroplasties) 0.9% Finnish Register (46281 arthroplasties) 0.9% Geneva Register (6101 arthroplasties)
Elbow arthroplasties	3.4% (2458 arthroplasties)
Femoral osteosynthesis	3.9% (541 operations)
Pin track care	7.0% (170 procedures)
Foot and ankle surgery	1.6% (555 operations)
Hallux valgus (Lapidus procedure)	1.2% (61 operations)
Arthroscopies	0.1–0.4% (352, 258 procedures)
Open fractures Gustilo grade I	0.9%
Open fractures Gustilo grade II	1.9%
Open fractures Gustilo grade III	12–52%
Amputation stump	5–22%

I. Uc,kay et al. J Hosp Infect (2013)

Classification of Open Fractures

Table 1

Gustilo-Anderson Classification of Open Fractures[1,2]

Type	Details
I	Open fracture with a wound less than 1 cm long, low energy, without gross contamination
II	Open fracture with a wound 1–10 cm long, low energy, without gross contamination or extensive soft-tissue damage, flaps, or avulsions
III	A: Open fracture with a wound greater than 10 cm with adequate soft-tissue coverage, or any open fracture due to high-energy trauma or with gross contamination, regardless of the size of the wound B: Open fracture with extensive soft-tissue injury or loss, with periosteal stripping and bone exposure that requires soft-tissue coverage in the form of muscle rotation or transfer C: Open fracture associated with arterial injury requiring repair

Type	Details
I and II	Cefazolin 2 g IV immediately and q8 hours × 3 total doses Penicillin allergic: Clindamycin 900 mg IV immediately and q8 hours × 3 total doses
III	Ceftriaxone 2 g IV immediately × 1 total dose Vancomycin 1 g IV immediately and q12 hours × 2 total doses Penicillin allergic: Aztreonam 2 g IV immediately and q8 hours × 3 total doses Vancomycin 1 g IV immediately and q12 hours × 2 total doses

- 60% to 70% of open fractures are contaminated by bacteria.
- risk of infection correlates significantly with the degree of soft tissue injury.

Characteristics of Orthopedic SSI

Indication	Classification
Location	Superficial (Subfascial) Deep soft tissue only Bone Joint
Implant presence	None present (no implant or biologic implant) Internal fixation Arthroplasty Biologic implant (eg, ligament, tendon, bone, and other tissue graft)
Implant removability	No implant (implant or biologic implant) Removal associated with high morbidity Removal associated with low morbidity
Classification of infection	Acute Chronic
Organism susceptibility	Susceptible to routine oral or IV antibiotics Difficult to treat microorganisms No organism identified
Host factors/medical status	No or limited comorbidities (healthy, ASA 1-2) Multiple comorbidities (frail, ASA 3-4)

ASA = American Society of Anesthesiology classification, IV = intravenous.

Antonia F. Chen, MD, MBA and Gregory A. Brown, MD, PhD. J Am Acad Orthop Surg (2020)

MEMO

Definition of Periprosthetic Joint Infection

Definition of Periprosthetic Join Infection According to the International Consensus Group. This Is An Adaptation of the Musculoskeletal Infection Society Definition of PJI.

PJI Is Present When One of the Major Criteria Exists or Three Out of Five Minor Criteria Exist	
Major Criteria	Two positive periprosthetic cultures with phenotypically identical organisms, **OR** A sinus tract communicating with the joint, **OR**
Minor Criteria	1) Elevated serum C-reactive protein (CRP) **AND** erythrocyte sedimentation rate (ESR) 2) Elevated synovial fluid white blood cell (WBC) count **OR** ++change on leukocyte esterase test strip 3) Elevated synovial fluid polymorphonuclear neutrophil percentage (PMN%) 4) Positive histological analysis of periprosthetic tissue 5) A single positive culture

Declaration: The consensus group wishes to state that PJI may be present without meeting these criteria, specifically in the case of less virulent organisms (e.g. *Propionibacterium acnes*). Thus, the clinicians are urged to exercise their judgment and clinical acumen in reaching the diagnosis of PJI.

Definition of Periprosthetic Joint Infection

Table 2
The Threshold for the Minor Diagnostic Criteria.

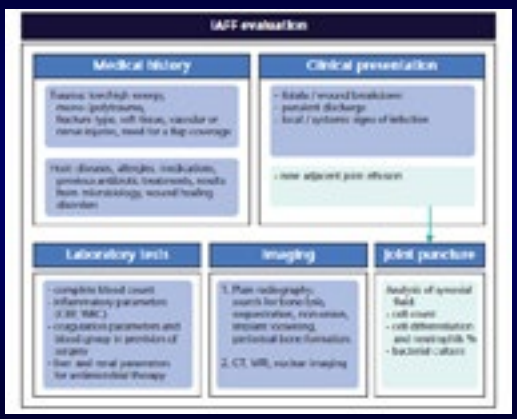
Criterion	Acute PJI (<90 days)	Chronic PJI (>90 days)
Erythrocyte Sedimentation Rate (mm/hr)	Not helpful, No threshold was determined	30
C-Reactive Protein (mg/L)	100	10
Synovia White Blood Cell Count (cells/μl)	10,000	3,000
Synovial Polymorphonuclear (%)	90	80
Leukocyte Esterase	+ Or ++	+ Or ++
Histological Analysis of Tissue	>5 neutrophils per high power field in 5 high power fields (×400)	Same as acute

The Journal of Arthroplasty (2014)

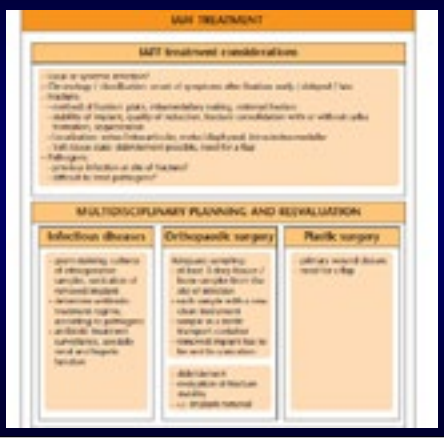
Definition of infection after fracture-related infection, as proposed by Metsemakers et al.

MEMO

Multidisciplinary diagnostic algorithm for infection after fracture fixation (IAFF), suggested by Metsemakers et al.(2018)



Multidisciplinary diagnostic algorithm for infection after fracture fixation (IAFF), suggested by Metsemakers et al.(2018)



Pin tract infection

- 21%-42%
- establishing a communication though the pins between environment and bone
- Loosening, osteomyelitis and loss of fixation

- redness surrounding the pin tract skin : not necessarily an infection sign.

MEMO

Pin tract infection prophylaxis and treatment

E. Guerado et al. Injury. (2019)

Four key principles in the treatment of osteomyelitis

by Cierny and colleagues

- 1. Debridement and dead space management
- 2. Stabilization
- 3. Soft tissue coverage
- 4. Adequate antibiotic administration

감사합니다

MEMO

홍영기 일산병원

EDUCATION

2001	연세대학교 의과대학 졸업
2009	연세대학교 의학과 석사

CAREER

2001~2006	세브란스 병원 인턴, 외과 전공의
2006~2009	군의관
2009~2010	신촌세브란스 병원 외과 전임의
2010~2011	국민건강보험공단 일산병원 외과 전임의
2011~2017	국민건강보험공단 일산병원 외과 전문의
2017~2018	Cleveland Clinic Florida 해외연수
2018~	국민건강보험공단 일산병원 외과 전문의

패혈증의 진단 및 적절한 처치

홍영기 일산병원

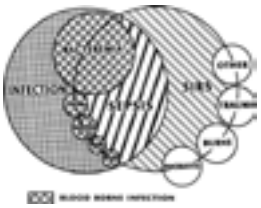
DIAGNOSIS (DEFINITIONs)

The ACCP/SCCM Consensus Conference Committee (1991)

- **SIRS: Systemic Inflammatory Response Syndrome**

A clinical response arising from a nonspecific insult manifested by ≥2 of the following:

- **Temperature**: ≥38°C or ≤36°C
- **HR**: ≥90 beats/min
- **Respirations**: ≥20/min
- **WBC count**: ≥12,000/mL or ≤4,000/mL or >10% immature neutrophils



Bone et al. Chest. 1992;101(6):1644-55.

MEMO

The ACCP/SCCM Consensus Conference Committee (1991)

- **Sepsis**

  ;SIRS 조건에 부합하면서 감염이 확인되었거나 감염에 의한 것으로 의심되는 것

- **Severe sepsis**

  ;장기 부전, 저관류(hypoperfusion) 또는 저혈압과 관련된 패혈증.

  저관류(hypoperfusion) 및 관류 이상(perfusion abnormality)은 젖산 증가, 빈뇨 또는 정신 상태(mental status)의 급성 변화를 포함 할 수 있지만 이에 국한되지는 않음.

- **Septic shock**

  ;적절한 수액 치료에도 불구하고, 관류 이상과 함께 패혈증으로 인한 저혈압

2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference

- SIRS는 여전히 유용한 개념이지만, SIRS의 진단 기준은 지나치게 민감(too sensitive)하고 구체적이지 않음(non-specific).
- 이러한 정의는 감염에 대한 호스트 반응의 정확한 정도(staging)를 판단하거나 예후를 예측하는데 부적합.
- 이러한 한계를 극복하기 위해 SIRS 기준에 biomarkers 등을 추가하여 미래에 더 나은 정의를 내릴 수 있겠음.

The Third International Consensus Definitions for Sepsis and Septic Shock (2015)

- **Sepsis**; life-threatening organ dysfunction caused by a dysregulated host response to infection.

감염에 대한 인체의 과도한 반응에 의해 치명적인 장기 부전이 발생하는 상태

MEMO

SOFA score

- Organ dysfunction can be identified as an acute change in total SOFA score 2 points consequent to the infection
- A SOFA score 2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection

JAMA. 2016;315(8):801-10.

Quick SOFA (qSOFA)

- Respiratory rate ≥22/min
- Glasgow Coma Scale <15 (Altered mentation)
- Systolic blood pressure ≤100 mmHg

Septic shock

- A subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality.

근본적인 순환기 및 세포 / 대사 이상이 사망률을 상당히 증가시킬 만큼 심각한 패혈증의 하위 집합

MEMO

Criteria for septic shock

- A need for vasopressor therapy to maintain a mean arterial pressure (MAP) ≥65 mmHg
  MAP≥65 mmHg을 유지하기 위해 vasopressor 필요
- A serum lactate >2 mmol/L (18mg/dL) despite adequate volume resuscitation
  적절한 수액치료에도 불구하고 lactate >2 mmol/L

->hospital mortality is in excess of 40%

Pathogenesis

Clin Med (Lond). 2018; 18(2): 146–149.

MANAGEMENTs

MEMO

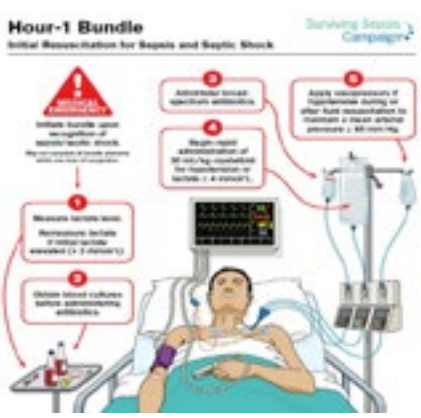
1. 소생술(Resuscitation)
2. 즉각적이고 적절한 항생제 치료(Prompt and appropriate antimicrobial therapy)
3. 적절한 수액 치료(Accurate fluid balance)
4. 원인 제거(source control)

Tom Evans. Clinical Medicine 2018;18(2):146-9

Origin	Website	Focus
Sepsis Trust	https://sepsistrust.org/education/clinical-tools/	UK based charity and originator of the 'Sepsis six'
		Produced in collaboration with NICE
National Institute for Health and Care Excellence (NICE) guidelines	www.nice.org.uk/guidance/ng51	Comprehensive though complex algorithms. Published before new sepsis definitions
Royal College of Physicians	www.rcplondon.ac.uk/guidelines-policy/acute-care-toolkit-9-sepsis	Distillation of NICE guidance and again uses older definitions
Royal College of Emergency Medicine	www.rcem.ac.uk/docs/Clinical%20standards%20and%20Guidance/Clinical%20Standards%20for%20Emergency%20Departments.pdf	Based on Sepsis Trust guidelines Tailored to emergency department use
Surviving sepsis campaign	www.survivingsepsis.org/Bundles/Pages/default.aspx	The most up to date and useful of the guidelines, using the new (2016) definitions of sepsis

MEMO

Surviving Sepsis Campaign



The Surviving Sepsis Campaign Bundle

- **Hour-1 bundle**

1. Measure lactate level. Remeasure if initial lactate is >2 mmol/L
2. Obtain blood culture prior to administration of antibiotics
3. Administer broad-spectrum antibiotics
4. Begin rapid administration of 30ml/kg crystalloid for hypotension or lactate ≥4 mmol/L
5. Apply vasopressors if patients is hypotensive during or after fluid resuscitation to matain MAP≥65 mmHg

Hour-1 Surviving Sepsis Campaign Bundle of Care.

MEMO

1. Measure Lactate Level

- 저산소증(tissue hypoxia)
- initial lactate is elevated (> 2mmol/L)
  ->remeasure within 2−4 h

2. Obtain Blood Cultures Prior to Antibiotics

- 패혈증이나 패혈성 쇼크가 의심되는 환자에서 항생제 투여에 상당한 지연을 야기하지 않는 한, 항생제 투여를 시작하기 전에 적절한 미생물 배양 (blood culture 포함)을 시행해야 한다(BPS).
- 적절한 미생물 배양은 항상 최소한 aerobic and anaerobic blood culture를 포함한다.

3. Administer Broad-Spectrum Antibiotics

1) 패혈증과 패혈성 쇼크의 인지로부터 가능한 일찍, 1시간 이내에 정맥 항생제가 투여되어야 한다. (strong recommendation, moderate quality of evidence)

2) 패혈증이나 패혈성 쇼크 환자에서 가능성 있는 모든 원인균을 커버할 수 있는 하나 또는 2가지 이상의 광범위 경험적 항생제가 투여되어야 한다(including bacterial and potentially fungal or viral coverage). (strong recommendation, moderate quality of evidence)

3) 일단 원인균과 항생제 감수성이 확인되고 임상적 호전을 보이면 경험적 항생제의 범위를 좁히는 것이 권고된다. (BPS)

MEMO

3. Administer Broad-Spectrum Antibiotics

- 경험적 항생제를 선택하기위해 반드시 고려해야할 인자들
  a. 감염 부위에 따른 일반적인 균주 정보와 개별항생제의 감염 부위 침투 능력
  b. 지역사회, 병원, 병동에서 균주 분포
  c. 분포 균주의 내성 비율
  d. 면역 결핍 (neutropenia, splenectomy, poorly controlled HIV infection and acquired or congenital defects of immunoglobulin, complement or leukocyte function or production)
  e. 나이, 환자의 기저 질환 : DM, Liver or renal failure, indwelling catheter

3. Administer Broad-Spectrum Antibiotics

- Multidrug-resistant pathogen 의심해야 할 때
  a. Prolonged hospital stay
  b. Recent antimicrobial use
  c. Prior hospitalization
  d. prior colonization or infection with multidrug-resistant organisms.

- Critically ill septic patients at high risk of infection of multidrug-resistant pathogens (Pseudomonas, Acinetobacter…) ->Add gram negative agent

3. Administer Broad-Spectrum Antibiotics

- broad-spectrum β-lactams & carbapenems에 대한 내성 균주 (gram-negative bacilli)의 위험을 반드시 고려.

- Risk factors for MRSA → vancomycin or teicoplanin

- Risk of Legionella species → macrolide or fluoroquinolone

MEMO

3. Administer Broad-Spectrum Antibiotics

- Candida species 의심해야 할 때
  - Immunocompromised status (neutropenia, Chemotherapy, transplant, DM, Liver failure, CKD), prolonged invasive vascular devices (HD catheter, CVC), TPN, necrotizing pancreatitis, recent major surgery(abdomen), prolonged administration of broad-spectrum antibiotics, prolonged hospital /ICU admission, recent fungal infection, multisite colonization
  -
- 경험적 항진균제로써 echinocandin (anidulafungin, micafungin, caspofungin) 사용을 고려하여야 하는 경우
  - Patients with severe illness in those patients with septic shock, who have recently been treated with other antifungal agents
  - Candida glabrata or candida krusei infection is suspected from earlier culture data

3. Administer Broad-Spectrum Antibiotics

4) 심한 비감염성 염증 상태에 있는 환자에서 전신적 예방적 항생제의 유지는 권장하지 않는다.(e.g., severe pancreatitis, extensisve burn injury) (BPS)

5) 패혈증이나 패혈성 쇼크환자에서 약력학과 약동학의 원칙과 특별한 약물 특성에 따른 최적화된 항생제 용량 전략이 필요하다.(BPS)

6) 패혈성 쇼크의 초기 치료를 위해 가장 가능성 있는 균주에 맞는 경험적 항생제의 병용 치료가 필요하다 (using at least two antibiotics of different antimicrobial classes). (weak recommendation, low quality of evidence)

3. Administer Broad-Spectrum Antibiotics

7) 균혈증과 쇼크가 없는 패혈증을 포함한 대부분의 치료를 위해서 병용 요법을 항상 사용하는 것은 권장되지 않는다. (weak recommendation, low quality of evidence)

8) 백혈구 감소성 패혈증과 균혈증을 위해 병용요법을 항상 사용하는 것은 권장하지 않는다. (strong recommendation, moderate quality of evidence)

MEMO

3. Administer Broad-Spectrum Antibiotics

9) 만약 패혈성 쇼크를 위해서 초기에 병용요법이 사용된다면, 임상적 호전과 감염의 해결이 되는 경우에 첫 몇 일 이내에 병용요법을 중단(de-escalation) 하는 것이 권장된다. 이것은 균배양 검사 결과가 양성이든 음성이든 적용된다.(BPS)

3. Administer Broad-Spectrum Antibiotics

10. 패혈증과 패혈성 쇼크와 관련된 가장 심각한 감염을 위해 7-10일의 항균 요법의 기간이 적절하다.(weak recommendation, low quality of evidence)

11. 임상적 호전이 느리거나 배액이 불가능한 감염, S.aureus 균혈증, 일부 진균이나 바이러스성 감염, 또는 면역억제상태에 있는 환자에서는 더 긴 기간의 항생제 사용이 필요하다.(weak recommendation, low quality of evidence)

3. Administer Broad-Spectrum Antibiotics

12. 복강내 또는 요로 감염의 효과적인 원인 조절에 의해 빠른 임상 호전이 있는 환자들에서 단기 항생제 사용이 적절하다.(weak recommendation, low quality of evidence)

13. 패혈증과 패혈성 쇼크환자에서 항생제의 de-escalation을 위해 매일 평가 하는 것이 권장된다.(BPS)

MEMO

3. Administer Broad-Spectrum Antibiotics

14. Procalcitonin 수치의 측정은 패혈증 환자에서 항생제 사용기간을 단축시키기위해 사용될 수 있다. (weak recommendation, low quality of evidence)

15. Procalcitonin 수치는 초기에 패혈증으로 보였지만, 그 뒤에 감염의 임상 증거가 제한적인 환자에서 경험적 항생제의 중단을 위해 사용될 수 있다. (weak recommendation, low quality of evidence)

Empiric Antibiotics for Sepsis

	Gram +	Gram −	Anaerobes	Pseudomonas	MRSA	ESBL	VRE
Vancomycin	X				X		
Linezolid	X				X		X
Daptomycin	X				X		X
Piperacillin-tazobactam	X	X	X	X			
Meropenem	X	X	X	X		X	
Doripenem	X	X	X	X		X	
Imipenem-cilastatin	X	X	X	X		X	
Ertapenem	X	X	X			X	
Ceftriaxone	X	X					
Cefepime	X	X		X			
Ciprofloxacin	X	X		X			
Levofloxacin	X	X		X			
Metronidazole			X				

ESBL = extended-spectrum β-lactamase producer; MRSA = methicillin-resistant Staphylococcus aureus; VRE = vancomycin-resistant enterococci.

Surg Infect. 2018;19(2):147-154.

4. Administer IV Fluid

- 패혈증과 패혈성 쇼크는 의학적 응급 상황이며 치료와 소생술(resuscitation)을 즉시 시작하는 것을 권고한다 (BPS).
- 패혈증으로 인한 저관류(hypoperfusion) 상태에서의 소생술은 처음 3 시간 이내에 최소 30mL / kg의 IV crystalloid fluid를 투여 할 것을 권고한다(strong recommendation, low quality of evidence).
- 초기 수액 소생 후 혈역학 상태를 자주 재평가하여 추가 수액을 조절하는 것을 권고한다(BPS).

MEMO

4. Administer IV Fluid

- Vasopressor가 필요한 패혈성 쇼크 환자의 초기 목표 평균 동맥압 (MAP)을 65mmHg로 권고한다 (strong recommendation, moderate quality of evidence).
- 우리는 조직 저관류(tissue hypoperfusion)의 지표인 lactate 수치가 높은 환자에서 lactate 정상화를 목표로 소생술을 조절할 것을 권고한다(weak recommendation, low quality of evidence).

5. Apply Vasopressors

- should not be delayed.
- 초기 수액 소생술 후 혈압이 회복되지 않는 경우, MAP≥ 65 mmHg을 유지하기 위해 첫 1 시간 이내에 vasopressor 투여.

5. Apply Vasopressors

1) Norephinephrine을 first-choice vasopressor로 권고한다(strong recommendation, moderate quality of evidence).
2) Vasopressin (최대 0.03 U / min) (weak recommendation, moderate quality of evidence), 또는 ephinephrine (weak recommendation, low quality of evidence)을 target MAP에 도달하기 위해 norephinephrine에 추가하거나, vasopressin (최대 0.03 U / min) (weak recommendation, moderate quality of evidence) 을 norephinephrine 용량을 줄이기 위해 사용하는 것을 권고한다.

MEMO

5. Apply Vasopressors

3) 일부 국한된 환자에게만 norephinephrine 대신 dopamine을 사용하는 것을 권장한다(e.g., patients with low risk of tachyarrhythmias and absolute or relative bradycardia) (weak recommendation, low quality of evidence).

4) 신장 기능 보전을 위해 저용량 dopamine을 사용하는 것은 권장하지 않는다(strong recommendation, high quality of evidence).

5) 적절한 체액 투여와 vasopressor 사용에도 불구하고 지속적인 hypoperfusion의 증거를 보이는 환자에게 dobutamine 사용을 권장한다(weak recommendation, low quality of evidence).

Bundle Element	Grade of Recommendation and Level of Evidence
1. Measure lactate level. Re-measure if initial lactate is > 2 mmol/L	Weak recommendation, low quality of evidence
2. Obtain blood cultures prior to administration of antibiotics	Best practice statement
3. Administer broad-spectrum antibiotics	Strong recommendation, moderate quality of evidence
4. Rapidly administer 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L	Strong recommendation, low quality of evidence
5. Apply vasopressors if patient is hypotensive during or after fluid resuscitation to maintain mean arterial pressure ≥ 65 mm Hg	Strong recommendation, moderate quality of evidence

Source control

- 패혈증이나 패혈성 쇼크가 있는 환자에서 응급 source control이 필요한 감염을 가능한 한 빨리 식별하거나 배제하고, 진단이 내려진 후 의학적, 논리적으로 실용적인 모든 치료를 즉시 시행 해야한다(BPS).
- 패혈증 또는 패혈성 쇼크의 원인이 될 수 있는 혈관 장치는 다른 혈관을 확보한 후, 즉시 제거하는 것을 권고한다(BPS).

MEMO


The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection

- Higher-risk patients
  1) sepsis or septic shock
  2) APACHE II score ≥10

- Potential higher-risk patients
  1) diffuse peritonitis
  2) delayed or inadequate source control

Source control

- 24시간 이내 source control을 해야 한다 (Grade 2-B). 패혈증 혹은 패혈성 쇼크 환자의 경우에는 보다 긴급한 방식으로 source control 을 해야 한다 (Grade 2-C).
- 가능하다면 최소침습방식으로 source control을 해야 한다(Graded 2-C).
- 적절한 source control이 가능하다면 severe peritonitis가 있는 환자에서 계획된 re-laparotomy를 시행하지 않는 것이 좋다(Grade I-B)

MEMO

Recommendations for Empiric Antimicrobial Therapy Community-acquired Intra-abdominal Infection

	Lower-risk patients	Higher-risk patients
Single agent	Ertapenem Moxifloxacinc	Piperacillin-tazobactam Doripenem Imipenem-cilastatin Meropenem
Combination regimens	Cefotaxime or ceftriaxone + metronidazole Ciprofloxacin + metronidazole	Cefepime + metronidazole Aztreonam + metronidazole + vancomycin

Recommendations for Empiric Antimicrobial Therapy for Health Care-Associated Complicated Intra-abdominal Infection

General approach

Piperacillin-tazobactam, doripenem, imipenem-cilastatin, meropenem, or cefepime plus metronidazole, with ceftazidime plus metronidazole and aztreonam plus metronidazole plus vancomycin as potential alternatives

Supplemental agents

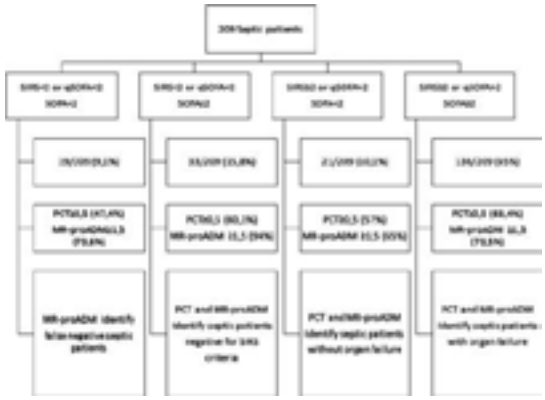
Potential pathogen	Recommendations
Enterococcus faecalis	Addition of ampicillin or vancomycin if not using piperacillin-tazobactam or imipenem-cilastatin
Enterococcus faecium	Vancomycin or teicoplanin
Vancomycin-resistant Enterococcus spp.	Daptomycin or linezolid
MRSA	Vancomycin, teicoplanin, daptomycin, or linezolid
ESBL-producing or AmpC-β-lactamase-producing Enterobacteriaceae	Use of a broad-spectrum carbapenem
KPC-producing Enterobacteriaceae	Combination therapy with a broad-spectrum carbapenem plus an aminoglycoside, polymyxin, or tigecycline; or ceftazidime-avibactam
MDR strains of Pseudomonas aeruginosa	Combination therapy with an aminoglycoside plus colistin, or ceftolozane-tazobactam or ceftazidime-avibactam
MDR strains of Acinetobacter baumannii	Combination therapy with a broad-spectrum carbapenem plus an aminoglycoside, polymyxin, or tigecycline
Candida albicans	An echinocandin (anidulafungin, caspofungin, micafungin) for critically ill patients, fluconazole for less critically ill patients
Non-C. albicans spp.	An echinocandin

Biomarkers

- WBC, CRP
- Lactate
- Procalcitonin
  ; the host-response marker
  ; early detection of infectious process in critically ill patients
  ; bacterial vs. viral disease (antibiotics use)
  ; Procalcitonin plasma concentration rises very rapidly (6-12h) after infection- best diagnostic value

- Mid-Regional pro-Adrenomedullin
  ; good relation with prognosis and mortality rate

MEMO



Spoto et al. Sci Rep. 2020; 10: 16605.

SEPSIS

• MEDICAL EMERGENCY

-. EARLY DIAGNOSIS
-. UGENT MANAGEMENT

MEMO

2020년 대한수술감염학회 학술대회 및 연수강좌

발행일 | 2020년 11월 20일
발행인 | **강중구**
편집인 | **이길연**
발행처 | **대한수술감염학회**
서울시 강남구 밤고개로 1길 10 현대벤처빌 1519호
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	Thickness	Size (cm)	
BETAfoam® N[2] 비점착성 Antiseptic Foam Dressing[3]	2 mm	10 x 10	M3032210
	5 mm	10 x 10	M3032210
		10 x 20	M3032212
		20 x 20	M3032216
		35 x 50	M3032218
BETAfoam® F[4] [Film] 환부 고정이 편리한 아크릴보더 필름 드레싱[5]	2 mm	5 x 5	M3032222
		5 x 10	M3032223
		5 x 20	M3032227
		10 x 10	M3032227
		10 x 20	M3032231
BETAfoam® T[6] [Tube] 카테터 및 튜브 등의 관 고정 부위[3]	3 mm	5 x 5	M3030772
		8 x 8	M3030521

PVP-I, povidone-iodine.

References. 1. Nasa. History. "50 Years Ago: Apollo 12 Rolls Out to Launch Pad. Adapted from https://www.nasa.gov/feature/50-years-ago-hornet-3-the-recovery-of-apollo-11 Accessed on Sep 17th, 2019. **2.** 베타폼®N 사용설명서 **3.** 2차치유폼제창상피복재(베타폼®N, T, 듀얼액션) 제조허가증(Rev. 14) 외부용 **4.** 베타폼®F 사용설명서 **5.** 2차치유폼제창상피복재(베타폼®F) 의료기기 제조품목허가증 대외용 **6.** 베타폼®T 사용설명서 **7.** 보건복지부 고시 치료재료 급여비 급여목록 및 급여상한금액표

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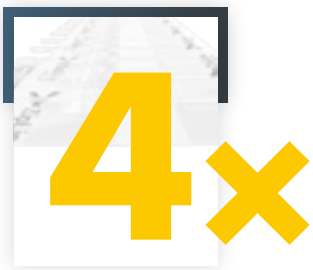

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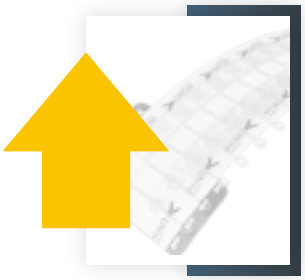

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