Infections of the foot and ankle- A logical approach to solve the problem

M Knupp, MD

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KANTONSSPITAL LIESTAL
GEMEINSAM FÜR DIE GESUNDHEIT

The classic orthopedic approach...

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Introduction

1. Prevalence of infections in F & A Surgery
2. Riskfactors for Infections of TAR
2. Risk for Infections in Forefoot surgery
3. Logical approach to solve the problem

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Prevalence

Postoperative Infection Rates in Foot and Ankle Surgery: A Comparison of Patients with and without Diabetes Mellitus

By Dane K. Wukich, MD, Nicholas J. Lowery, DPM, Ryan L. McMillen, DPM, and Robert G. Frykberg, DPM, MPH

J Bone Joint Surg Am. 2010;92:287-95

- 1000 Patients
- 19% with Diabetes
- infection rate 4.8%
- Patients with Diabetes (with neuropathy) 5x higher risk

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Prevalence

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- Treatment: 65% mild: oral antibiotics (out patients)
- 35% severe infections: surgery

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Prevalence

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- Riskfactors
  - Diabetes
  - Rheumatoid arthritis
  - Peripheral vascular disease

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Prevalence

- Prevalence of infections in F & A surgery is high
- Frequently high risk patients
  - Previous surgery
  - Diabetes
  - Peripheral vascular disease
  - …

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Riskfactors for Infections of TAR

Risk Factors for Periprosthetic Ankle Joint Infection: A Case-Control Study

Bernhard Kessler, MD, Parham Sendi, MD, Peter Graber, MD, Markus Knupp, MD, Lukas Zwicky, MSc, Beat Hintermann, MD, and Werner Zimmerli, MD

JBJS Am, Oct 2012

- **Prevalence of infections in TAR**
- **Identification of patient- and surgery related risk factors**

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Methods

Cohort of 408 TAR

Patients with infection

Diagnosis: pain, effusion, erythema, induration

+ ≤ 1 signs:

- microorganism growth in cultures
- visible pus surrounding the joint
- acute inflammation in histological examination
- ability to probe the implant

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Results

26 / 408 Infections

7 TAR externally implanted

own prevalence of infections: 4.7%

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Results

Microorganism

Microorganism	No. of Patients	%
*Staphylococcus aureus**	9	35
Coagulase-negative staphylococci	8	31
Enterococcus species	4	15
Enterobacter species	3	12
Klebsiella pneumoniae	2	8
Propionibacterium acnes	2	8
Streptococcus milleri	1	4
Pseudomonas aeruginosa	1	4
Achromobacter	1	4
Polymicrobial infection	4	15

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Results

Indication of arthroplasty

Risk Factor	Case Group (Periprosthetic Joint Infection)* (N = 26)	*	OR (95% CI)	P Value	*	OR (95% CI)	P Value
Indication for total ankle arthroplasty *(no.)*							
Primary osteoarthritis	8 (31%)	16 (31%)	1 (0.35-2.83)	1	25 (48%)	0.47 (0.17-1.31)	0.15
Rheumatoid arthritis	2 (8%)	3 (6%)	1.33 (0.23-7.98)	0.75	1 (2%)	4.00 (0.36-44.11)	0.26
Posttraumatic arthritis	14 (54%)	33 (64%)	0.64 (0.23-1.78)	0.39	26 (50%)	1.18 (0.44-3.17)	0.74
Revision of a preexisting ankle arthrodesis	4 (15%)	0 (0%)	—‡	0.01†	1 (2%)	—‡	0.03

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Results

Characteristics prior to TAR

Characteristics prior to index arthroplasty							
Prior surgery at site of infection *(no.)*	20 (77%)	29 (56%)	4.56 (0.98-21.35)	0.05	22 (42%)	4.78 (1.53-14.91)	0.01
Mean VAS pain score (stand. dev.)	6.5 (1.7)	5.7 (1.9)	—	0.14‡	6.3 (1.8)	—	0.79‡
Mean range of ankle motion (stand. dev.) *(deg)*	30.2 (12.3)	37.1 (12.5)	—	0.05‡	35.7 (14.5)	—	0.15‡
Mean AOFAS hindfoot score (stand. dev.)	35.8 (13.4)	49.8 (18.8)	—	<0.01‡	47.6 (18.9)	—	0.02‡

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Results

Index surgery

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Index surgery							
Mean duration (stand. dev.) *(min)*	119 (49)	84 (34)	—	<0.01‡	93 (30)	—	0.02‡
Total ankle arthroplasty without arthrodesis *(no.)*	12 (46%)	41 (79%)	0.24 (0.08-0.69)	0.01	44 (85%)	0.14 (0.04-0.51)	<0.01
Total ankle arthroplasty with arthrodesis *(no.)*	8 (31%)	10 (19%)	2.08 (0.63-6.81)	0.23	8 (15%)	2.26 (0.77-6.66)	0.14
Revision total ankle arthroplasty	6 (23%)	1 (2%)	—‡	<0.01†	0 (0%)	—‡	<0.01†

Results

Postoperative Course

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Postoperative course *(no.)*							
Persistent wound dehiscence (≥14 days)	8 (31%)	2 (4%)	15.38 (2.91-81.34)	0.01	2 (4%)	15.38 (2.91-81.34)	0.01
Secondary wound drainage	7 (27%)	3 (5.8%)	7.00 (1.45-33.70)	0.02	7 (13.5%)	5.31 (1.01-26.78)	0.04

Discussion

- be aware of ‘superficial wound infections’ (increased risk after 8-10 days)
- higher rates of infections in TAR than THR / TKR
- higher risk for infections in
  - long surgical time / additional procedures
  - revisions
  - previous surgeries (posttraumatic cases)

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Biofilm formation on percutaneous Kirschner-wires

Influence of material properties on recurrence rates after correction of toe deformities

Clauss M, Pannhorst S, Graf S, Hintermann B, Ilchmann T, Knupp M

submitted

Hypothesis

- **Recurrence of toe deformities is related to low-grade infections**
- **Biofilm formation can be reduced by the use of Ti - Wires**

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Methods

Prospective comparative study

Cohort of 143 toe deformities temporarily fixed with KW

89 toes fixed with SS – KW

54 toes fixed with Ti - KW

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Methods

KW removal in outpatients clinic after 42 days

Tip of the KW shortened with a sterile punch

Sonication for quantitative and qualitative biofilm analysis

(> 100 cfu / ml low-grade (biofilm) infection)

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Results

Outcome N=143	ss N (%)	ti N (%)	p-value
recurrence	32 (36)	7 (13)	0.003
pain	41 (46)	12 (22)	0.004
swelling	31 (35)	12 (22)	0.134
hypertrophic scar	8 (9)	2 (4)	0.320
normal shoes	64 (72)	37 (69)	0.707

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Results

germ	all N (%)	ss N (%)	ti N (%)	p-value
no (≤ 100cfu/ml)	67 (56.8)	38 (50.7)	29 (67.4)	0.086
yes (> 100cfu/ml)	51 (43.2)	37 (49.3)	14 (32.6)	
1 germ	52 (78.8)	33 (75)	19 (86.4)	0.609
2 germs	11 (16.7)	8 (18.2)	3 (13.6)	
3 germs	3 (4.6)	3 (4)	0 (0)	

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Results / Discussion

- 49% of the KW's showed a low grade infection
- Titanium KWs showed
  - less biofilm formation
  - better clinical results
  - less recurrence of deformity
  - less pain
- Consider Ti KW's, particularly in combined procedures

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Treatment of the infected TAR

Prosthetic-Joint Infections

Werner Zimmerli, M.D., Andrej Trampuz, M.D., and Peter E. Ochsner, M.D.

N Engl J Med 2004;351:1645-54.

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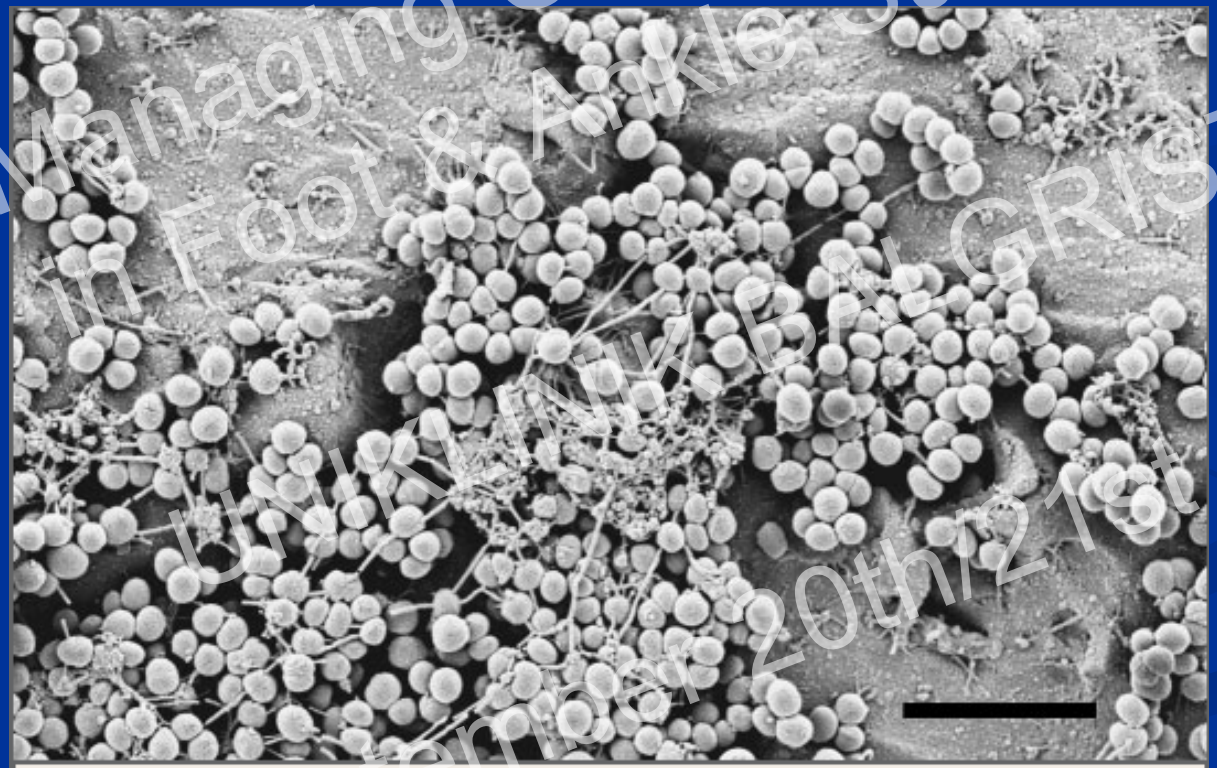

Figure 1. Scanning Electron Micrograph of a *Staphylococcus epidermidis* Biofilm on Foreign Material.

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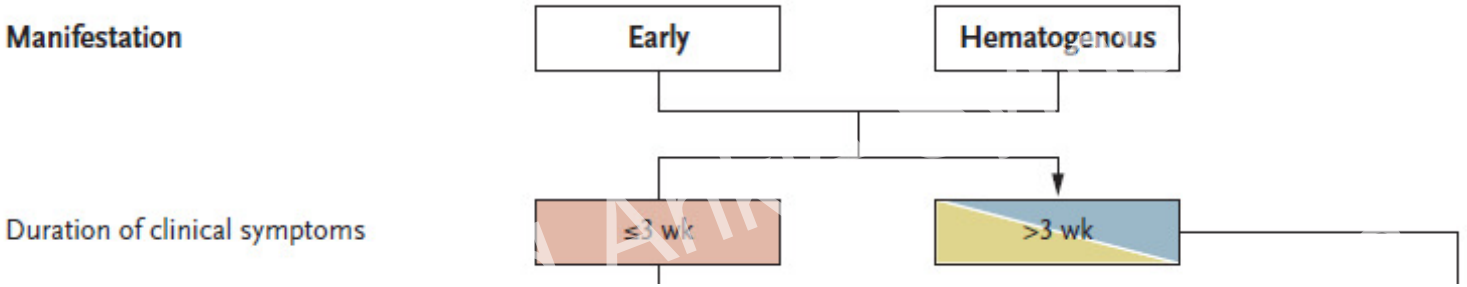
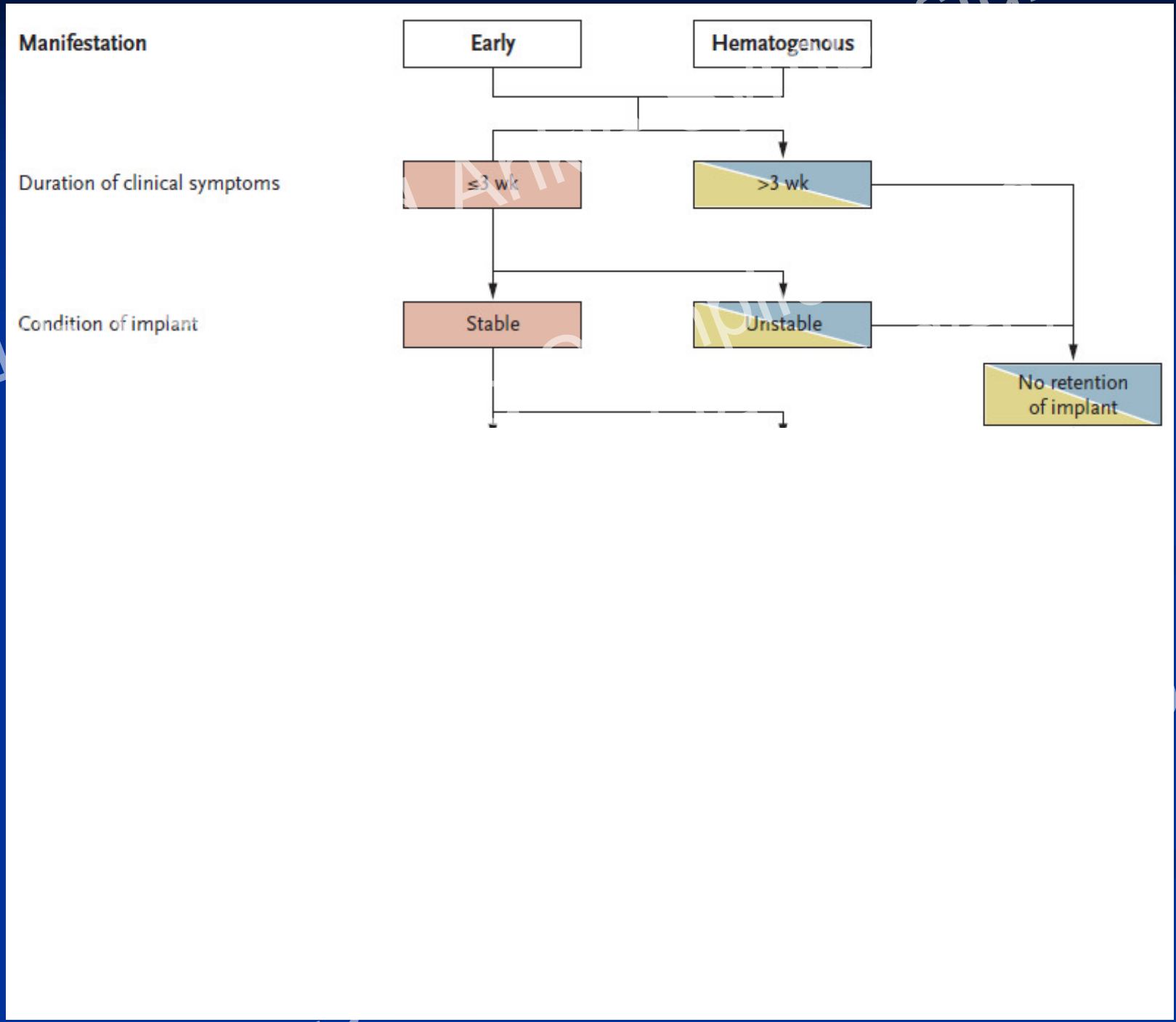

Manifestation
Early
Hematogenous
Duration of clinical symptoms
≤3 wk
>3 wk


Manifestation
Early
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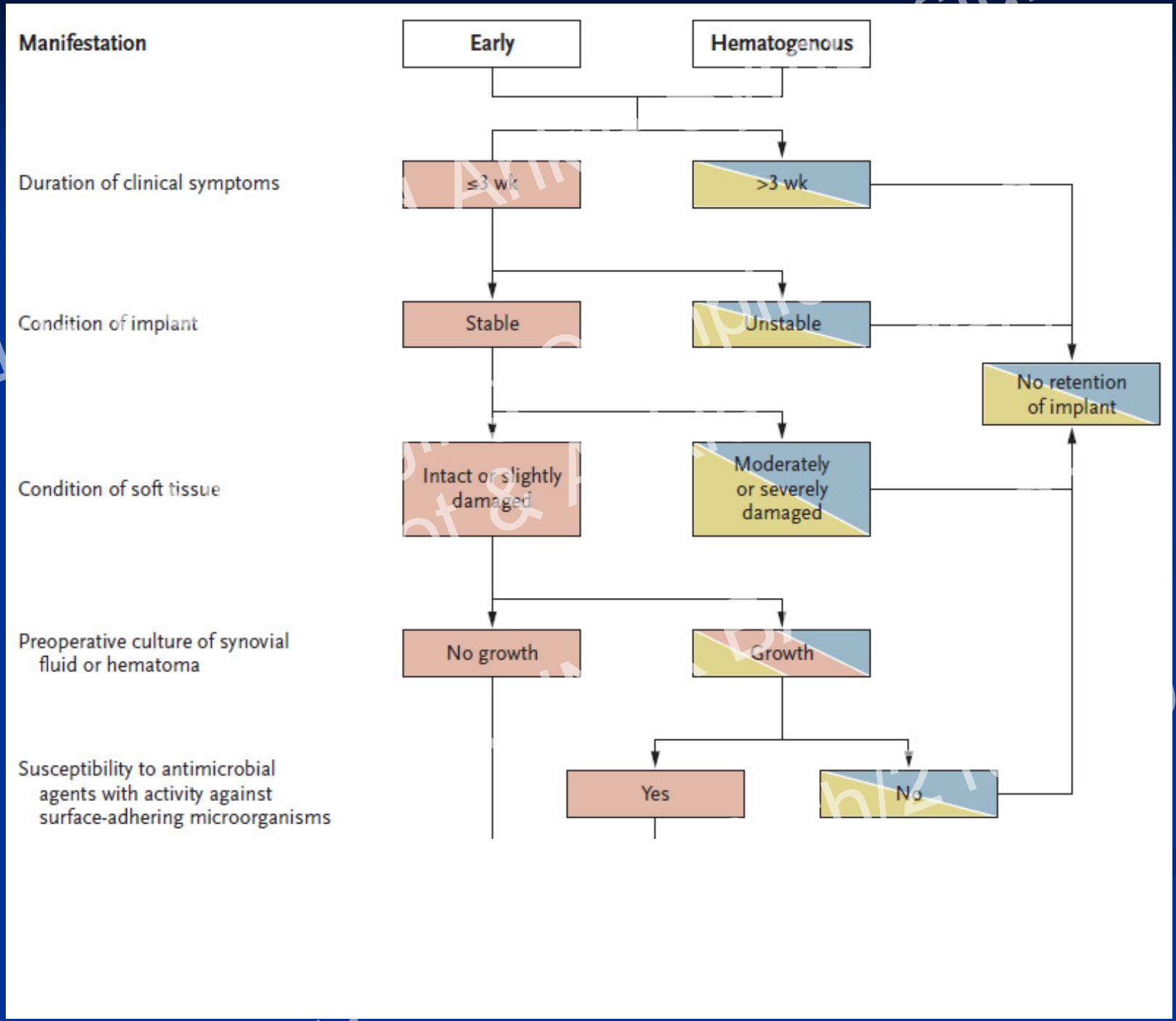
Duration of clinical symptoms
≤3 wk
>3 wk
Condition of implant
Stable
Unstable
No retention of implant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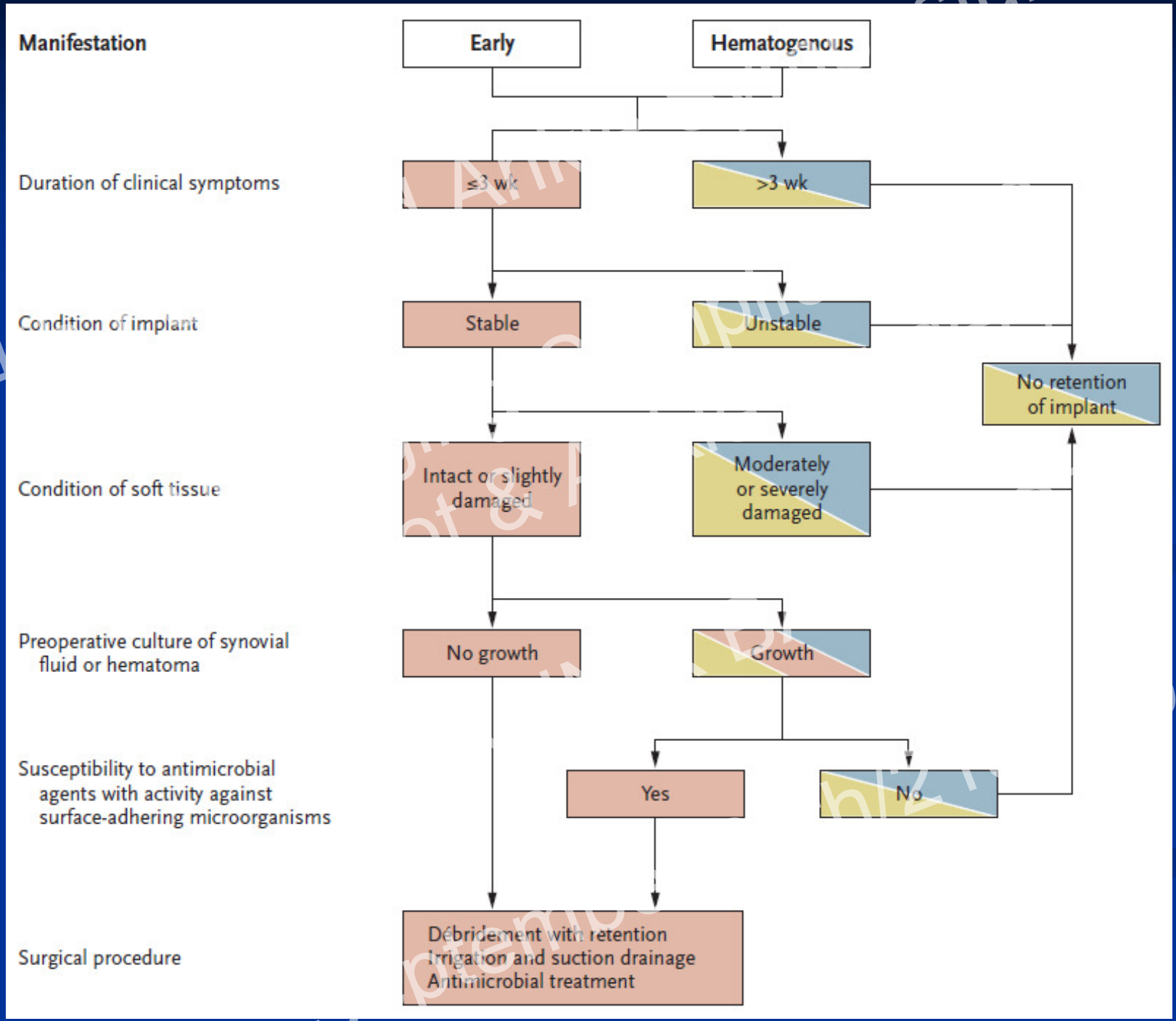
Duration of clinical symptoms
≤3 wk
>3 wk
Condition of implant
Stable
Unstable
No retention of implant
Condition of soft tissue
Intact or slightly damaged
Moderately or severely damaged
Preoperative culture of synovial fluid or hematoma
No growth
Growth
Susceptibility to antimicrobial agents with activity against surface-adhering microorganisms
Yes
No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Preoperative culture of synovial fluid or hematoma
No growth
Growth
Susceptibility to antimicrobial agents with activity against surface-adhering microorganisms
Yes
No
Surgical procedure
Débridement with retention
Irrigation and suction drainage
Antimicrobial treatment

No retention of implant

Soft tissue Condition

Intact or slightly damaged

Severely damaged

Modifying Circum-stances

Surgical procedure

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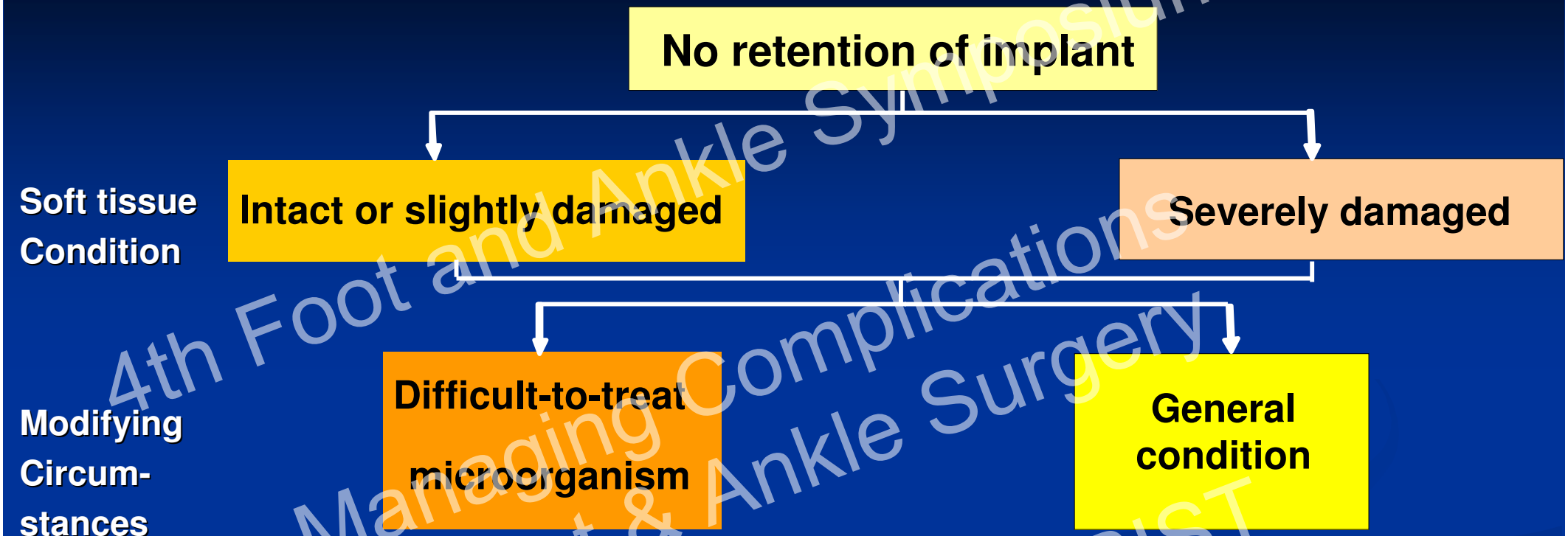

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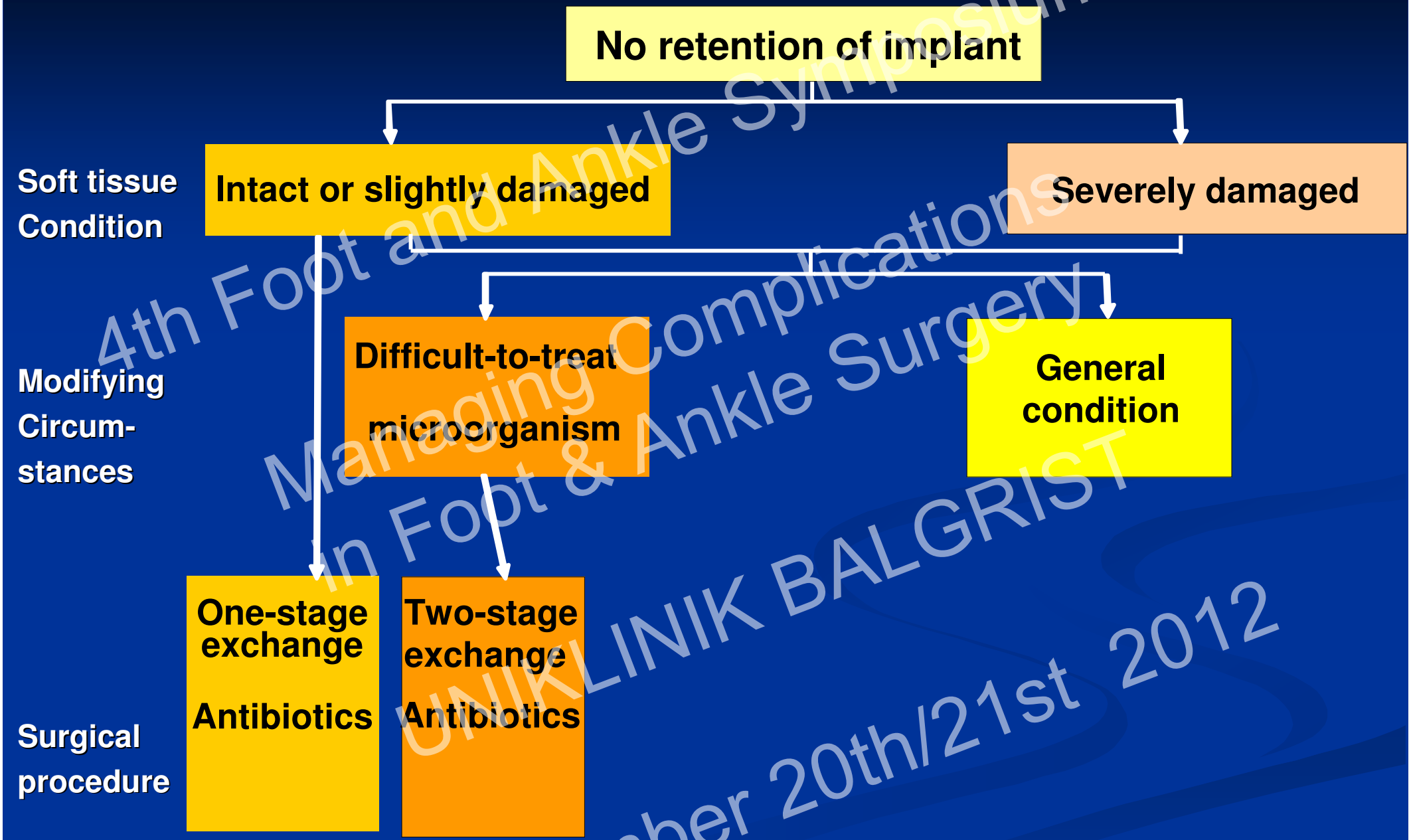

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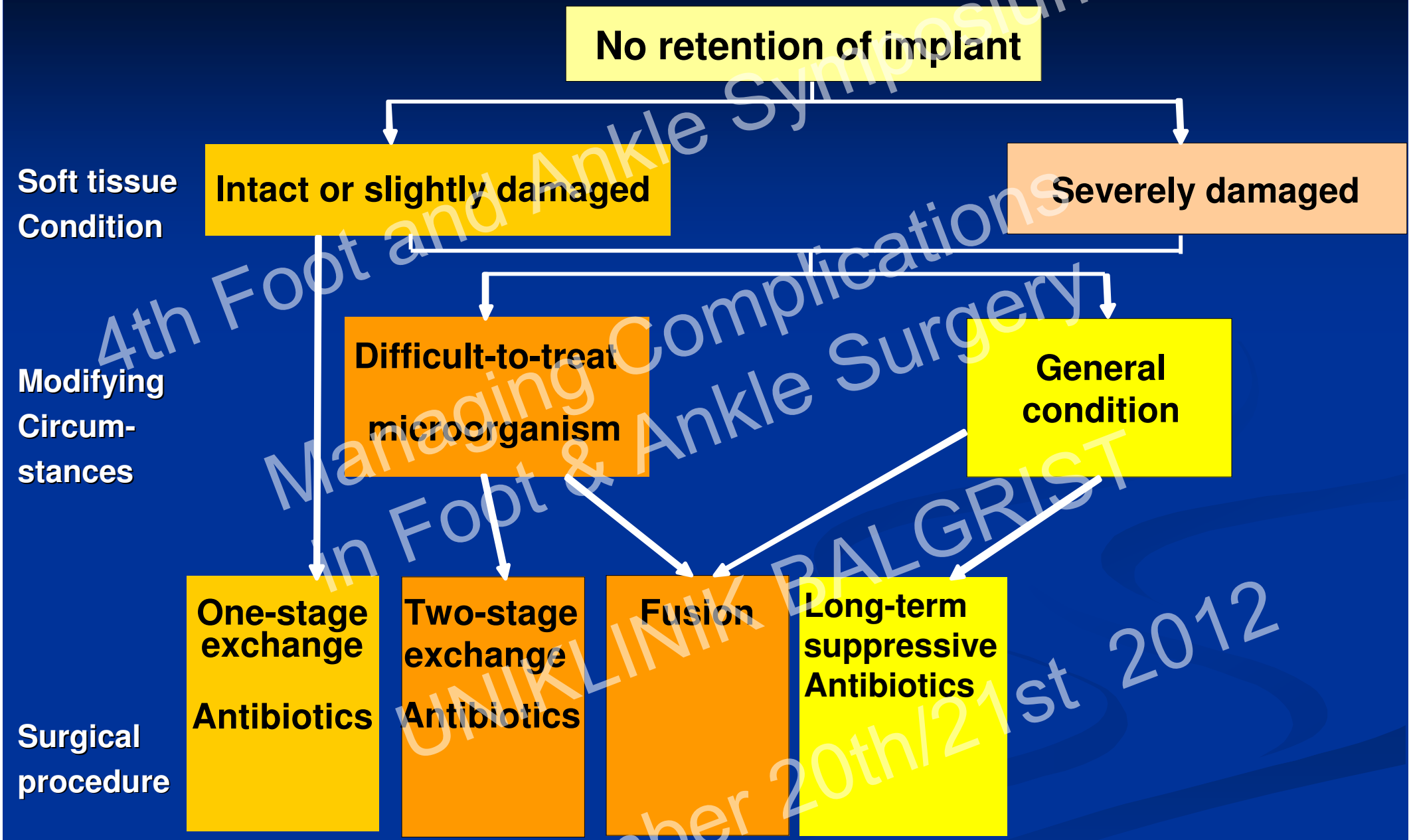

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Fusion

Technique: Isolated TT-Fusion in infected TAR

33 y, f

- **Failed TAR**

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Fusion

Technique: Isolated TT-Fusion in infected TAR

33 y, f

- **Failed TAR**

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Fusion

Large defect in infected TAR

70 y, f

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Fusion

Large defect in infected TAR

70 y, f

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Fusion

Large defect in infected TAR

70 y, f

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Fusion

Large defect in infected TAR

70 y, f

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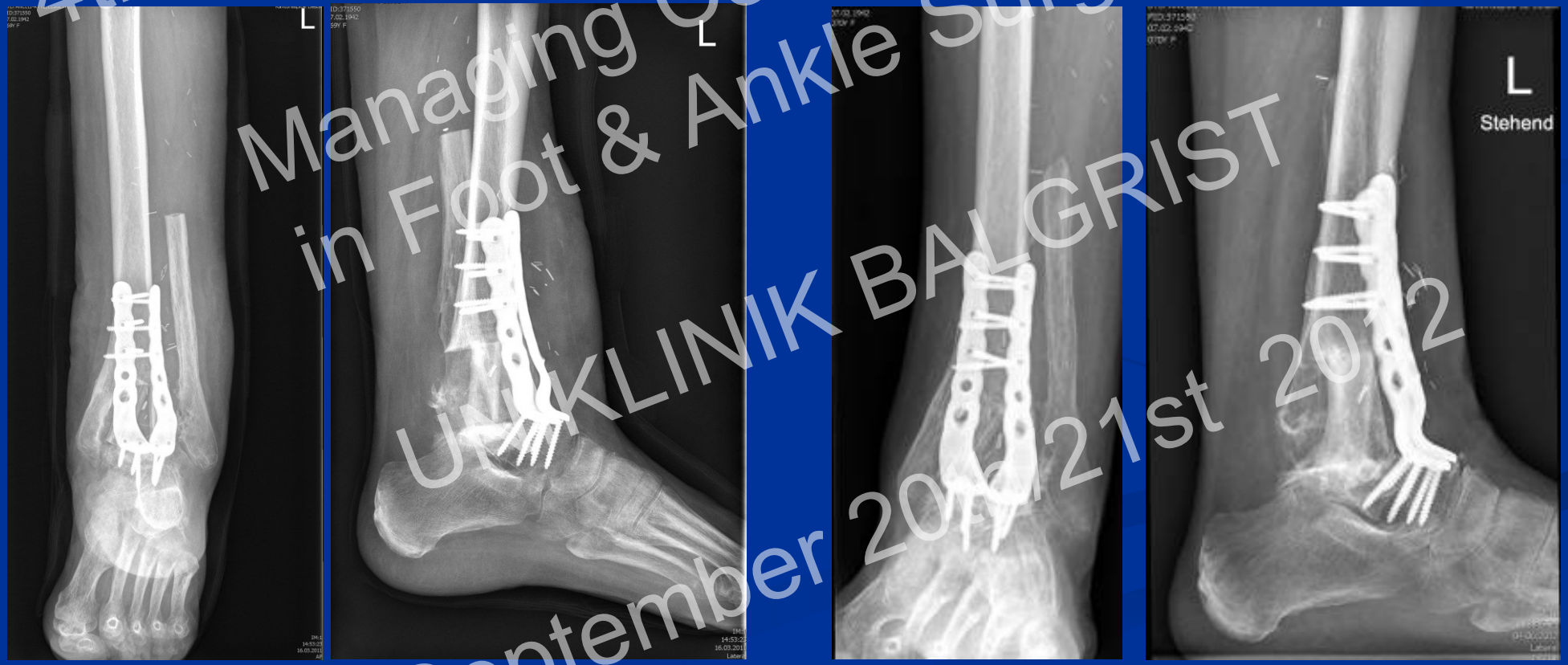
Fusion

Large defect in infected TAR

70 y, f

18 months postoperative



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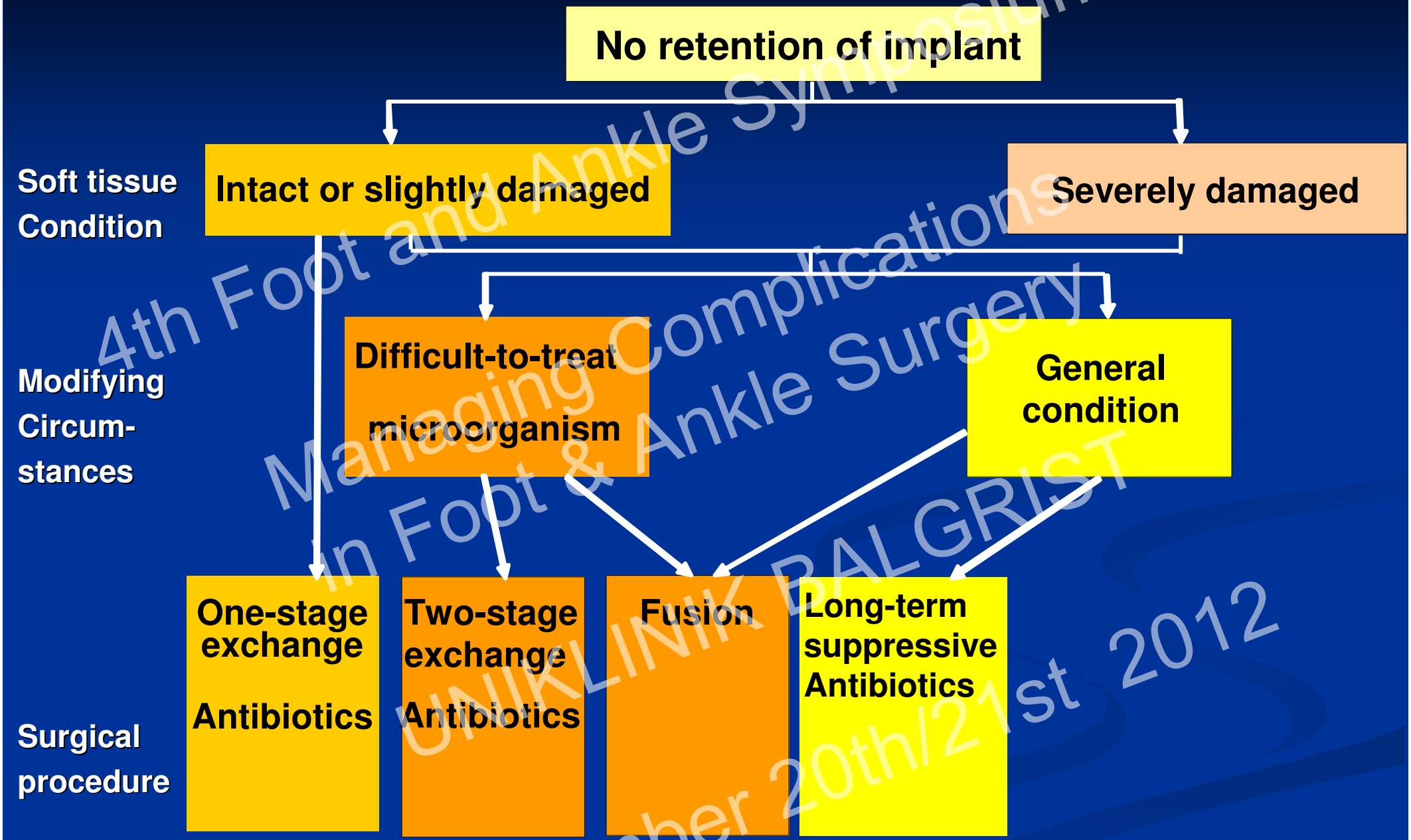

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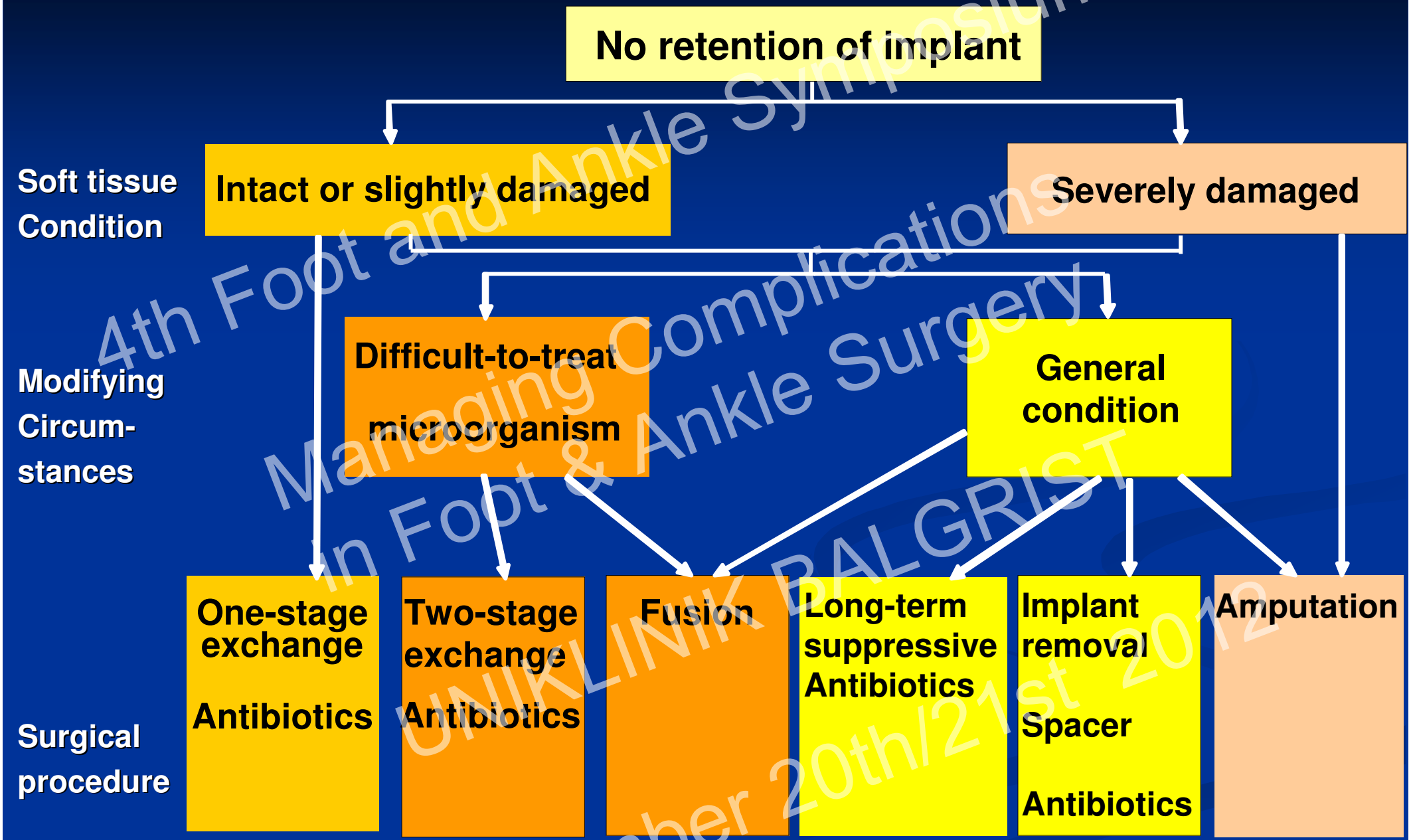

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Fusion

Large defect in infected TAR, AVN of the talus

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Summary

Infections in Foot and Ankle surgery are frequent

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Summary

Infections in Foot and Ankle surgery are frequent

Combined procedures increase the risk for infections

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Summary

Infections in Foot and Ankle surgery are frequent

Combined procedures increase the risk for infections

Infections of TAR require a multidisciplinary treatment approach

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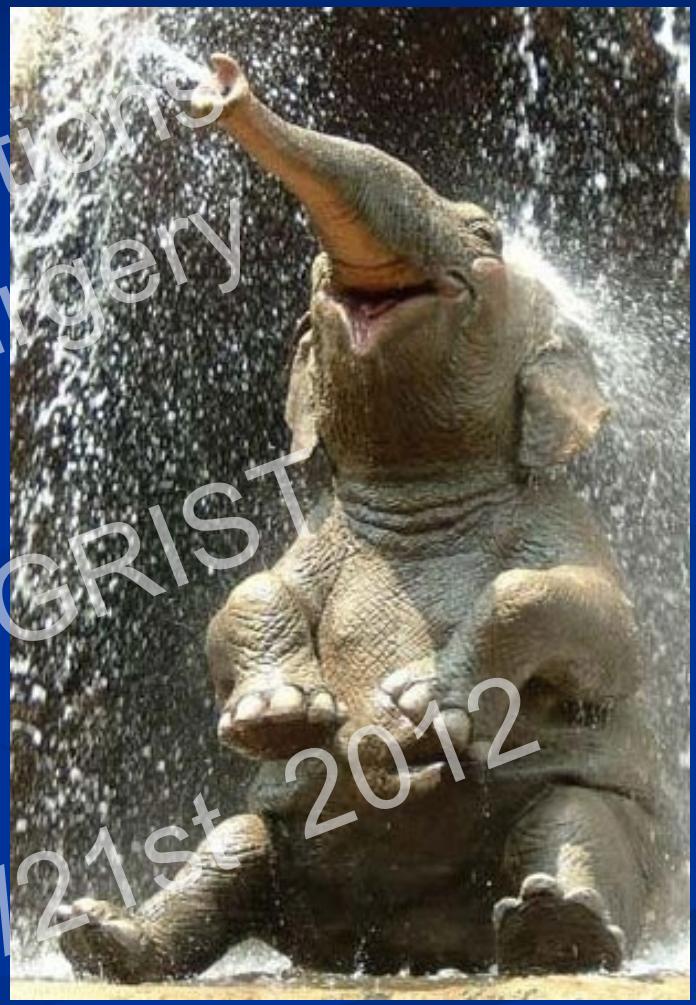

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