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國際問題
解決松

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How Can a Board Game Effectively Train Medical Students' Aseptic Techniques and Minimally Invasive Surgical Skills?

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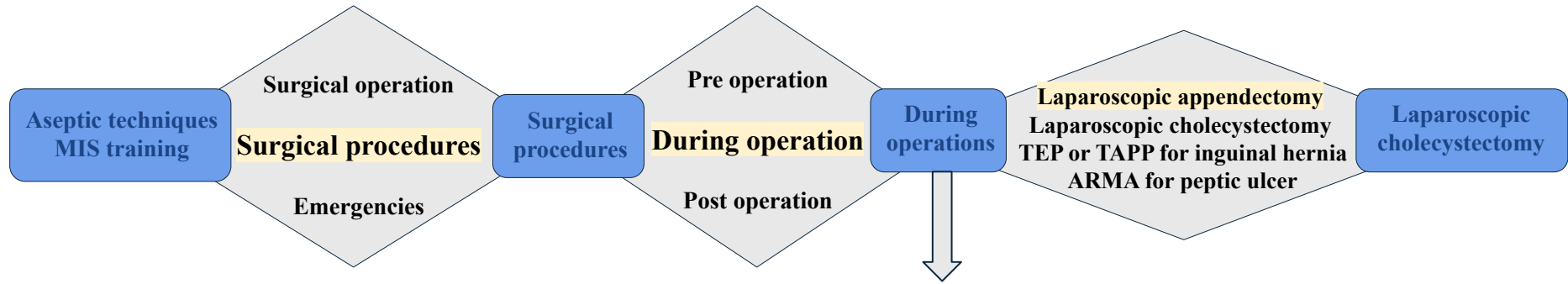


GOALS

Driessen et al. and Marrelli et al. have mentioned that in minimally invasive surgery, the factor most likely to contribute to surgical risk is the surgeon's lack of experience (Driessen et al., 2017, Marrelli et al., 2014).

Therefore, we aim to design a board game (**Operating Room Crisis/手術室風雲**) that **enhances medical students' understanding of aseptic techniques and proficiency in minimally invasive surgical procedures**. Through repeated practice, it reinforces memory, promotes teamwork and communication, and ultimately improves the effectiveness of medical education and training.

Triple Diamond Model (Marin-Garcia et al., 2020)



1. High-cost
2. Complexity
3. Importance

OR Crisis: Game Design

Our board game is divided into the "Preoperative Aseptic Challenge" and the "Minimally Invasive Surgery."

Preoperative Aseptic Challenge

An instructor or teaching assistant evaluates each medical student's aseptic technique. If a student makes an error, the round ends, and the instructor provides corrective guidance.

Mission Execution and Emergencies

After a successful assignment, the on-duty doctor plays either a "Surgery Success Card" or a "Emergency Card." If all cards are success cards, the mission is successful; if any failure card appears, the mission fails and triggers an **emergency**. The visiting staff must answer a medical question—if answered correctly, the patient temporarily survives but one failure is recorded; if **answered incorrectly, the patient dies and the game ends.**

Minimally Invasive Surgery: Laparoscopic cholecystectomy

Each of five rounds begins with five medical students racing to correctly **sequence the "Five Steps of Minimally Invasive Surgery."** The **first student to correctly finish** becomes the **visiting staff** and chooses an on-duty doctor. All players then vote on whether to start the procedure. If the majority votes "yes," the mission begins. Else, it counts as a failed vote. The game ends if three failed votes accumulate.

Professionals' Review

After the game ends, the instructor reviews the surgical procedure, operational steps, and key knowledge points, and facilitates a **discussion or Q&A session** to deepen the medical students' understanding and learning.

OR Crisis: Board Game Rules

Figure	4 doctors, 1 hidden virus, 1 host/medical instructor
Scene	Operating room
Event	Laparoscopic cholecystectomy腹腔鏡膽囊切除術
Process	<ul style="list-style-type: none">● Preoperative Aseptic Challenge → An error results in immediate failure.● Minimally Invasive Surgery Round → The visiting staff selects the doctor, and a vote determines whether the mission begins.● Mission Execution → Play “Surgery Success” or “Emergency” cards; reveal cards to confirm outcome.● Emergency → If a “Emergency” card appears, answer a medical question; failure may end the game.
End Conditions	<ul style="list-style-type: none">● Failure: Failing aseptic challenge, accumulating 3 failed votes, or total failures ≥ 2● Victory: Completing the sterile challenge, all surgical operations are successful, and total failures ≤ 1

=> Clear rules and scenario settings allow medical students to experience the **challenges of clinical decision-making and teamwork**.

Video narration

[drive link](#)

[YT Link](#)

Game cards

4 Doctors



1 Hidden Virus



Mission Cards



Surgery Success

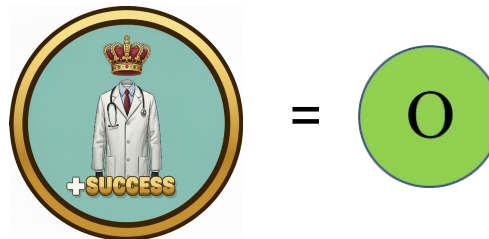


Emergency

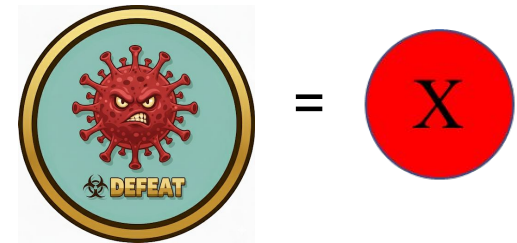
Visiting Staff: assigning doctors



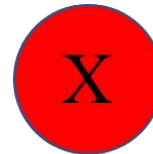
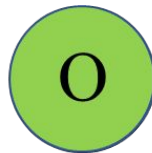
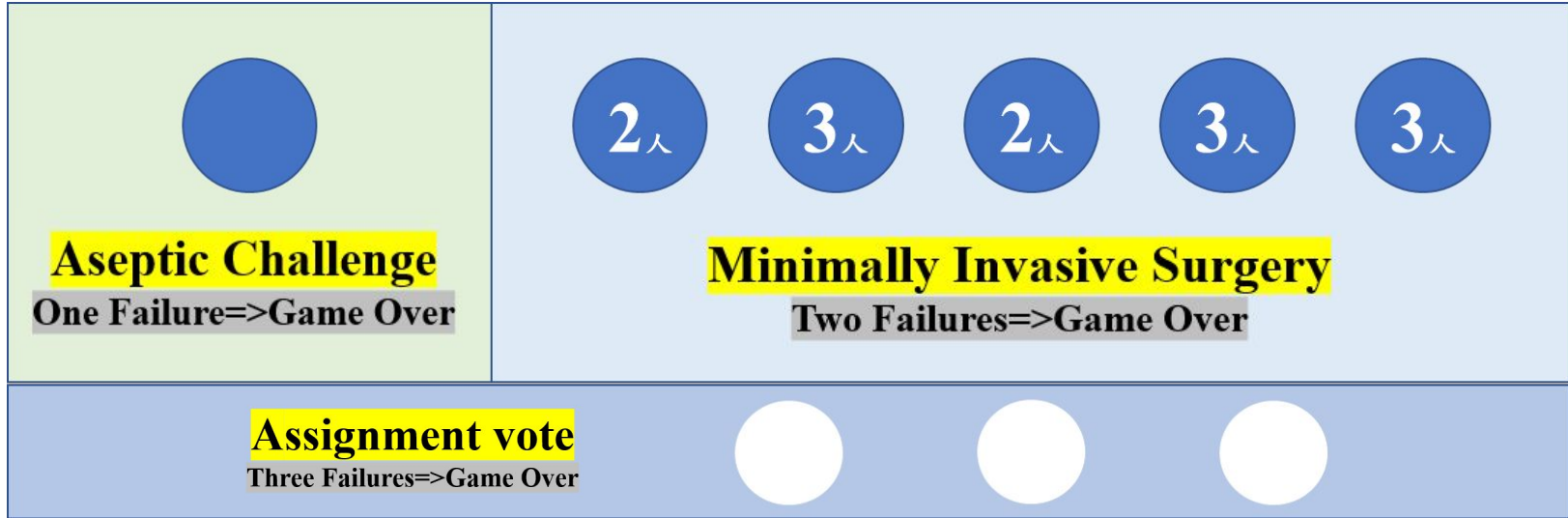
Mission Success



Mission Failure



Aseptic Technique and Minimally Invasive Surgery Steps Board



Aseptic Technique: Opening Sterile Surgical Pack



Tutorial: <https://reurl.cc/z5Xkra>

Checkpoint:

External package label shows black stripes
Internal indicator tape shows black stripes

Steps for Opening Sterile Packages

1. Do not open from outside to inside or from far to near
2. Do not grip the outer side of the wrapper to pull it open
3. Do not touch the inner surface of the wrapper
4. Do not speak toward the sterile field without wearing a mask
5. Non-sterile items must not cross over the sterile field; the edges of the sterile field should be considered contaminated areas

Seven Principles of Sterility

1. Sterile area: above the waist, below the chest
2. Wear a mask
3. Non-sterile items must not cross over sterile items
4. Sterilized items or sterile materials should avoid exposure to air
5. Use sterilized items within their expiration date
6. Keep non-sterile items away from the sterile field
7. Sterile items must not become wet

Assessment method

To comprehensively assess the effectiveness of our board game, we use a multi-faceted assessment approach that covers **knowledge, operations and teamwork**.

Knowledge test

Through sterile operations and emergency questions and answers, the medical students' mastery of medical knowledge is assessed.

Operational proficiency

Observe the correctness of medical students' five-step sequence of minimally invasive surgery and actual operation processes in the game, and record the number of successes and failures to quantify operational proficiency.

Teamwork

Examine how medical students assign roles, engage in voting and discussion, and collaborate on tasks during the game, in order to evaluate their teamwork skills.

These assessment methods are designed to provide comprehensive feedback from teachers to better guide medical students' learning and growth.

Expected Results

Game Plays	Average surgical failures per person/case
First	2.5
Third	1.2
Fifth	0.8
Eighth	0.2

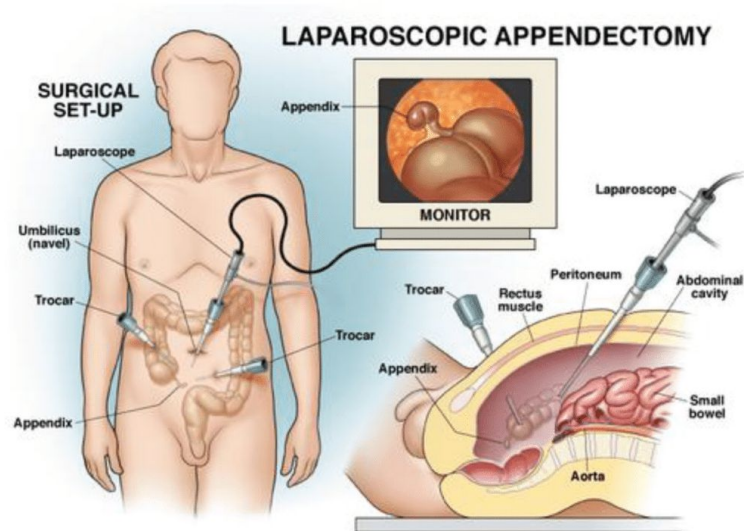
Knowledge Type	Pre-game average score	Post-game average score
Aseptic Operation	80%	90%
MIS Process	80%	85%
Emergency Response	75%	80%



- Time: Each game lasts ~30 minutes; 2–3 sessions can fit into a class.
- Location: Anywhere
- Cost: Homemade version ~NTD 500–600; medical prototype \leq NTD 3,000, far cheaper than traditional training.
- Instructional support: Guided by teachers/TAs; content validated by designers and doctors for accuracy.
- Participants: Medical students, who boost engagement and learning through gameplay.

In the future

If proven effective, we will develop a laparoscopic appendectomy expansion for this board game.



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Thank You for Your Attention !

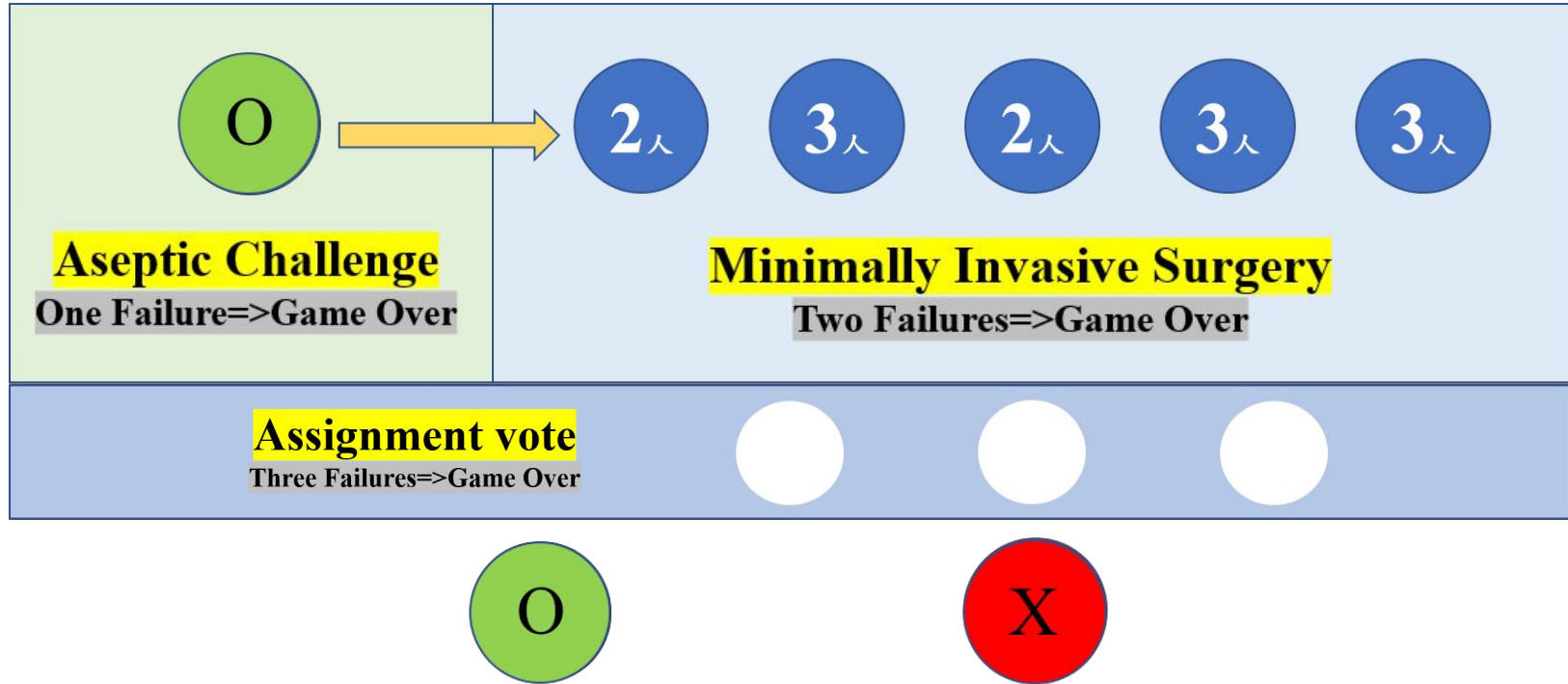


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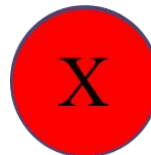
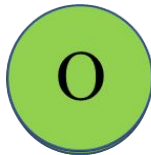
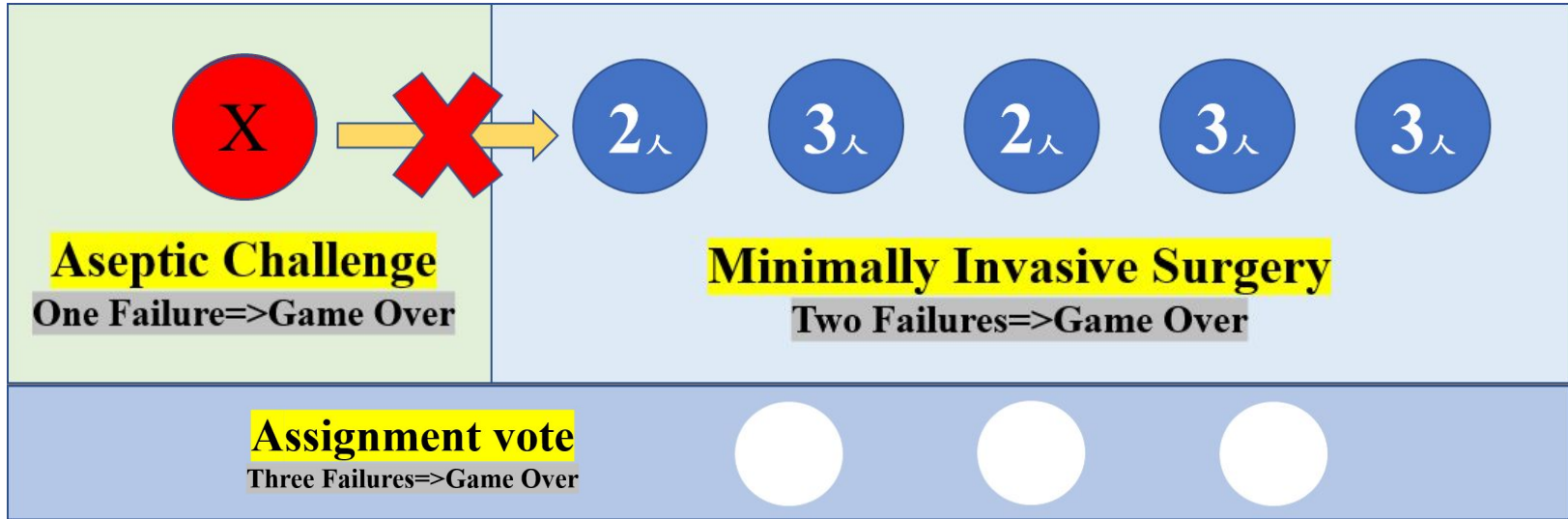
Problemthon & Solvethon 國際問題
解決松



Successful Aseptic Procedure Advance to Minimally Invasive Surgery



Failed Aseptic Procedure: Game Over



Minimally Invasive Surgery Step Cards:

First to correctly sequence surgical steps becomes team leader

Haribhakti & Mistry, 2015

Laparoscopic Cholecystectomy

After general anesthesia,
3–4 small incisions are
made in the abdomen,
and carbon dioxide is
insufflated to expand the
abdominal cavity.



EMERGENCIES

Incorrect Trocar Placement - Failure to avoid important blood vessels and organs, which may increase surgical difficulty (Alkatout, 2017).

Hypotension - Pneumoperitoneum compresses the inferior vena cava and may lead to gas embolism; the remedy is to pause insufflation and deflate (Peng et al., 2023).

Subcutaneous Emphysema - CO₂ leakage into subcutaneous tissue; actually not that serious, but may still occur clinically (Ott, 2014).

Pneumoperitoneum Establishment Failure - Severe adhesions (GAME OVER). Rare but may force conversion to open surgery. It is the most critical step in minimally invasive surgery (Balkin et al., 2016). Note: Gradual insufflation for elderly; prior surgery may contraindicate laparoscopy.

Minimally Invasive Surgery Step Cards:

First to correctly sequence surgical steps becomes team leader

Laparoscopic
Cholecystectomy

Insert the
laparoscope
and surgical
instruments.



EMERGENCIES

Bowel Injury - Accidental bowel perforation during instrument insertion. Contact with other tissues such as fat causes laparoscope fogging, requiring removal and cleaning. Proficiency in this procedure is crucial for young surgeons as it is relatively common clinically (van der Voort et al., 2004).

Minimally Invasive Surgery Step Cards:

First to correctly sequence surgical steps becomes team leader [2]

Laparoscopic Cholecystectomy

Using the visual guidance from the monitor, identify and dissect the cystic duct and cystic artery.



EMERGENCIES

Bile Duct Injury - Most severe complication; incidence remains unchanged. Challenging diagnosis; suitable as boss challenge (de'Angelis, 2021).

Tissue Adhesion - Acute cholecystitis causes severe tissue adhesion; can serve as a curveball question (Molinas et al, 2010).

Hemorrhage - Accidental cystic artery tear **requires** immediate hemostasis, but **note** that it is time-consuming (Sinha & Gupta, 2023).

Minimally Invasive Surgery Step Cards: The player who arranges the surgical steps correctly in the shortest time becomes the visiting staff.

Laparoscopic Cholecystectomy

Detach the gallbladder from the liver and remove it through the small incision at the navel.



EMERGENCIES

Wrong Dissection Plane - Entering the hepatic parenchymal layer, including the following three types (Humm et al., 2023):

- **Liver Injury** - Improper electrocautery causes bleeding; surgery must stop.
- **Gallbladder Perforation** - Bile leakage contaminates abdomen; prolonged recovery.
- **Gallstone Spillage** - Rupture spills stones into abdominal cavity.

Retrieval bag rupture - Bile or pus contaminating incisions, as the second friction may break (Huynh et al., 2019).

Minimally Invasive Surgery Step Cards: The player who arranges the surgical steps correctly in the shortest time becomes the visiting staff.

Laparoscopic Cholecystectomy

After the surgeon achieves hemostasis, suture the incision with thread and cover the surgical wound with a waterproof dressing.

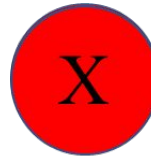
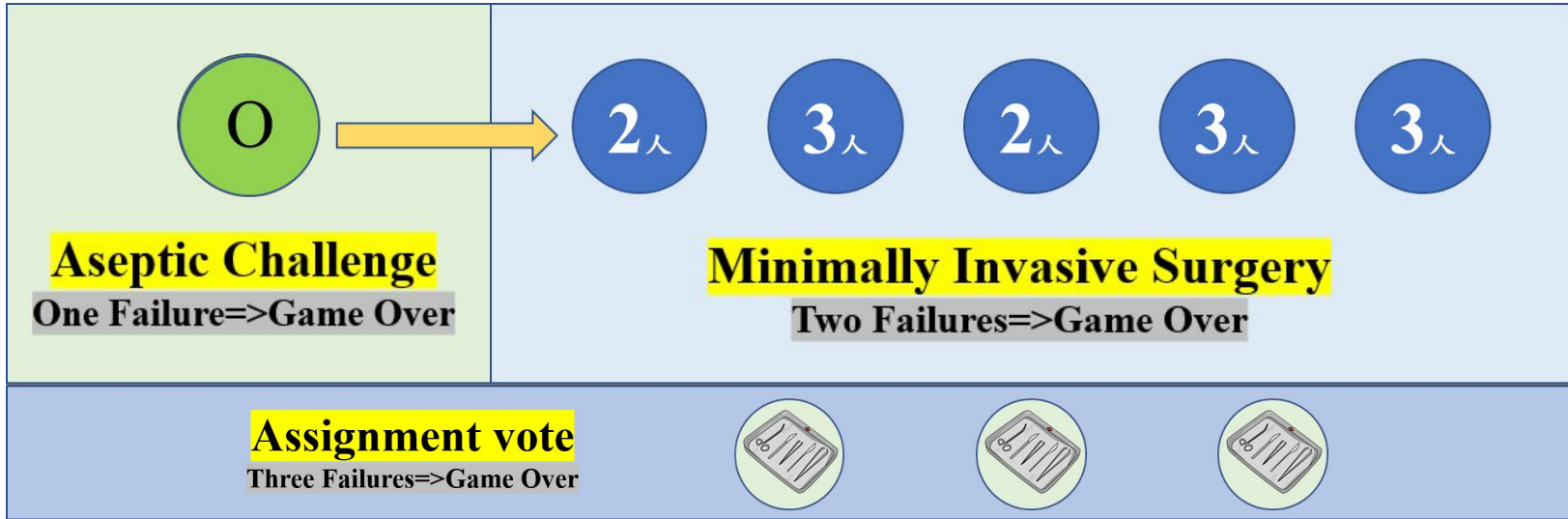


EMERGENCIES

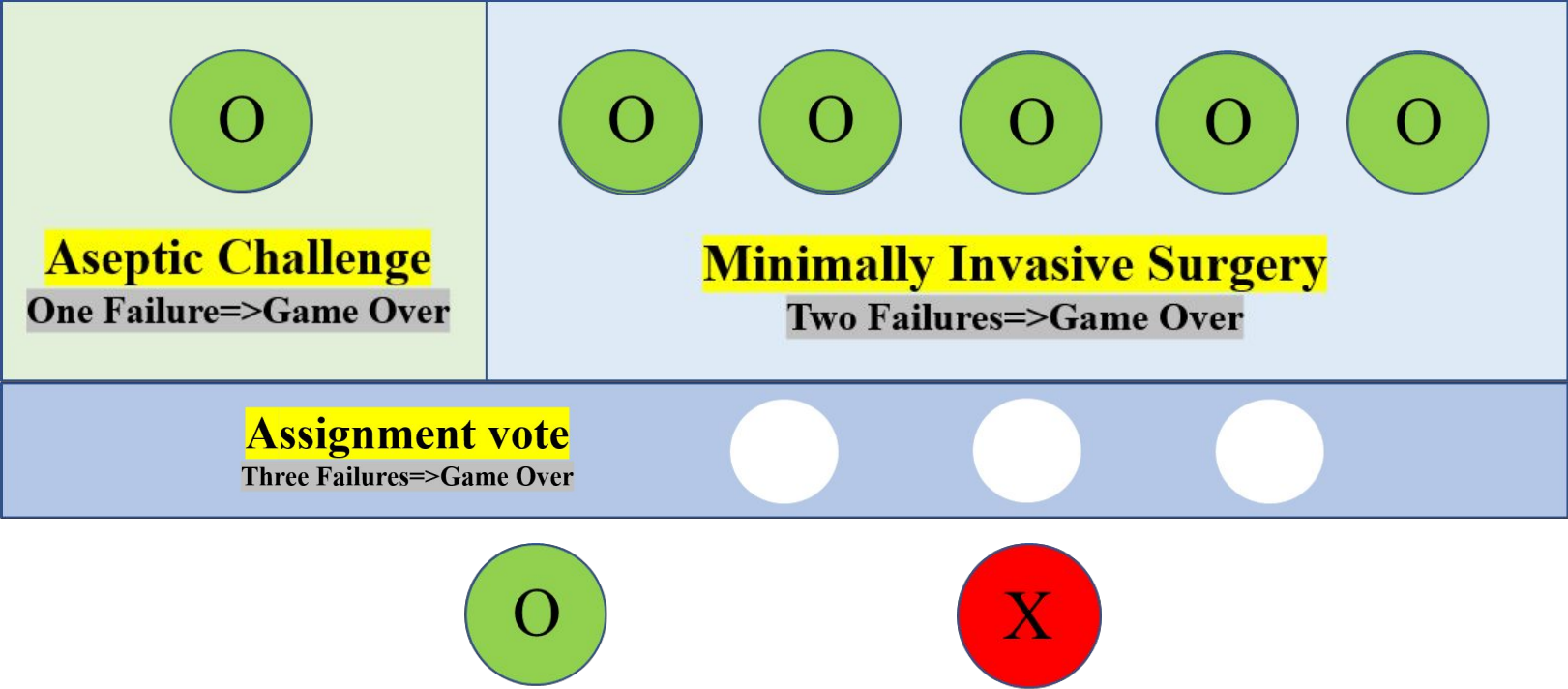
Postoperative bleeding - Bleeding from the gallbladder bed or trocar site, usually detected within 1–2 days after surgery (Sebastian et al., 2024).

Intra-abdominal infection - Gallbladder rupture leading to a subhepatic abscess (IAI), typically detected within 1–2 days after surgery (Coccolini et al., 2015).

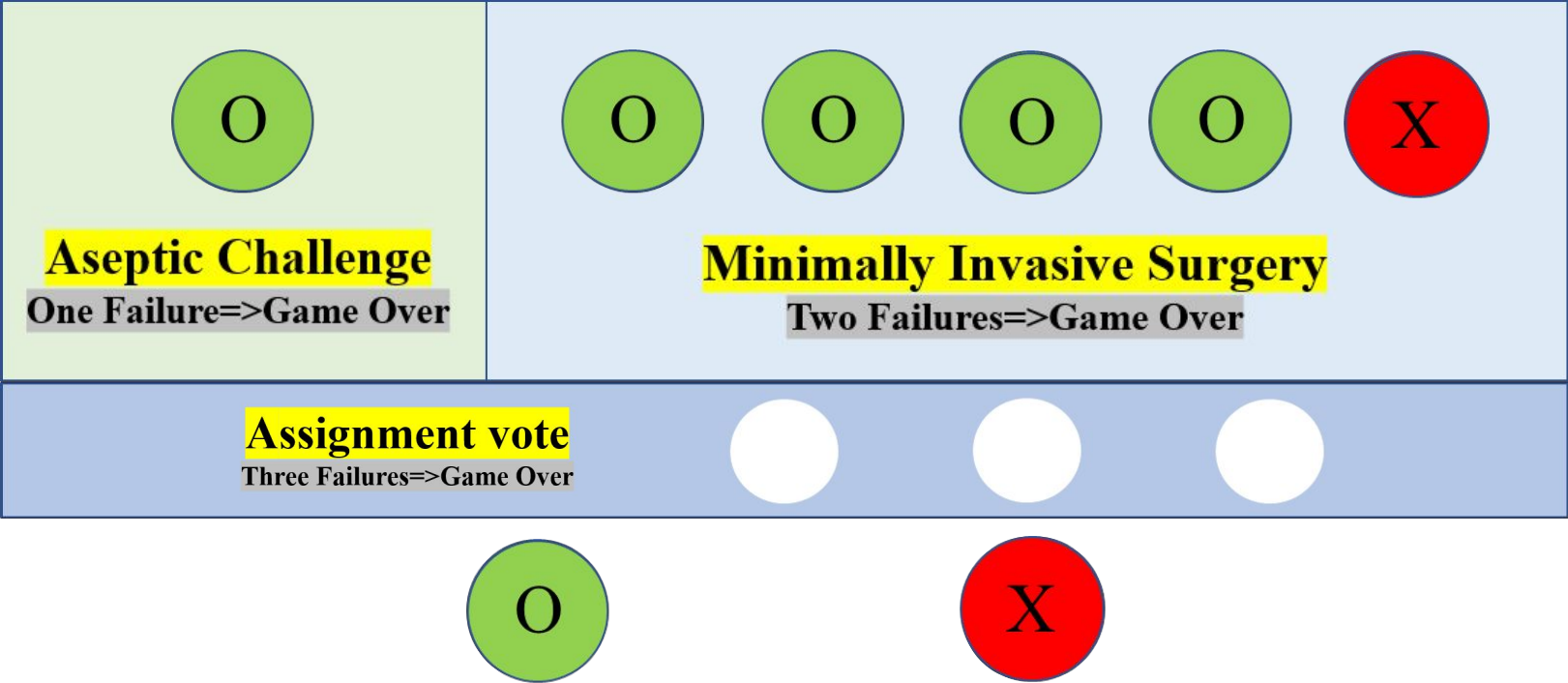
Surgical Failure: GAME OVER



Sterile Technique and Minimally Invasive Surgery Procedure Board (Success)



Sterile Technique and Minimally Invasive Surgery Procedure Board (Success)



Sterile Technique and Minimally Invasive Surgery Procedure Board (Failed)

