ONTOLOGICAL ANALYSIS OF LAPAROSCOPE MANIPULATION FOR THE DEVELOPMENT OF FULLY AUTOMATED LAPARPSCPE MANIPULATOR

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sages2023.137057c

Background and Objective

For the development of fully automated laparoscope manipulator, ontological analysis of laparoscope manipulation is required for the artificial intelligence (AI). Ontology is defined as explicit formal specification of terms or concepts in a domain and relations in the field of AI.

This study suggests a method of ontological analysis of laparoscope manipulation and investigates the feasibility of applying an ontological analysis for the developments of fully automated laparoscope manipulator.

Material and Methods

Situation and action between surgeon and laparoscope during the endoscopic surgery were analyzed, and they were ontologically described and investigated.

Results ①

Ontological description of situation & action

Situation

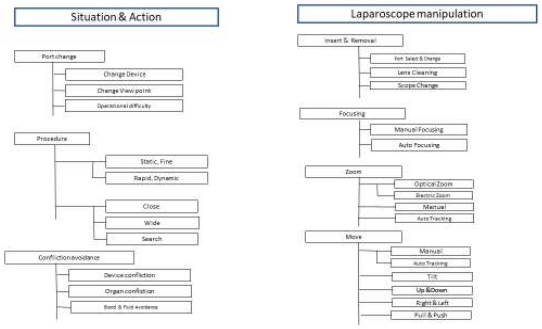
- Close-up view vs wide view
- Change port
  - for procedure
  - for change view
- Search
- Confliction avoidance
  - device confliction
  - organ confliction
  - blood & fluid avoidance

Action

- Remove & Insert
  - Port Change
  - Scope change
  - Lens cleaning
- Focus Manual---Auto
- Zoom Optical---Electrical
  - zoom in & zoom out
- Move Optical --- Electrical
  - Manual---Auto(&/orAI)
    - Tilt
    - Up&Down
    - Right & Left
    - Pull & Push

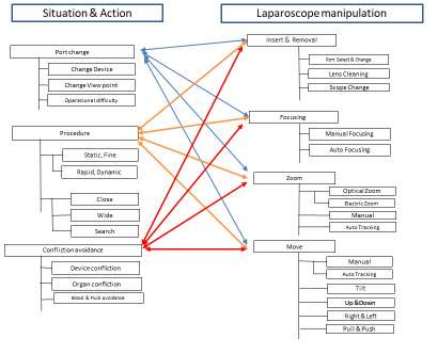
Results ②

Ontology of Laparoscope maniputation



Results ③

Interaction of Laparoscope maniputation



Results and discussion

Surgeon's manipulation of laparoscope, such as focus, zoom, tilt , search, confliction avoidance during endoscopic surgery were successfully classified and described with reference to the ontological concepts.

Several types of human-machine interface had been developed and proposed for laparoscopic manipulator. For the development of totally automated laparoscopic manipulator, ontological analysis of interaction between surgeon and laparoscope is essential .

- Control Module
- Voice Recognition
- Gyrosensor
- Gaze Input
- A.I.



CONCLUSION

Ontological descriptions of laparoscope manipulation are feasible and promising for the developments of totally automated laparoscope manipulator. Also, the ontological descriptions laparoscope manipulation can be applied in several areas, such as medical alert systems for patient safety , evaluation of surgeon's skill.

