TMU-Research Center of Urology and Kidney

Monthly Meeting

Times：2025/7/24(Thursday) 9:00-10:00

Google meet link： https://meet.google.com/ihn-wugo-jfv

Meeting Chairperson：Kuan-Yu Hung

Participant：

【TMUH】Ming-Che Liu、Shauh-Der Yeh、Chien-Chih Wu、Jeng-Cheng Wu、Ching-Hsin Chang、Te-Chao Fang、I-Wen Wu 、Hsi-Hsien Chen、Yang-Jen Chiang 、Ching-Yi Chen 、Yen-Chung Lin、Chih-Chin Kao、Yueh-Chu Sio、An-Chi Chou

【WFH】Yu-Ching Wen、Yuh-Mou Sue 、Ming-Che Lee、Wei-Wen Chang 、Yung-Wei Lin、Chi-Hao Hsiao、Syuan-Hao Syu、Chung-Howe Lai、Cho-Hsing Chung、Chung-Yi Cheng 、Tso-Hsiao Chen、Chung-Te Liu、Yun-Hong Yang、Yu-Hsiang,Yang

【SHH】Chia-Chang Wu、Kuan-Chou Chen、Chia-Hung Liu、Yi-Te Chiang、Kai-Yi Tzou、Wei-Tang Kao、Su-Wei Hu、Mei-Yi Wu、Lie-Yee Hung、Cai-Mei Zheng、Chia-Te Liao、Ruey-Shyang Soong、Min-Kuang Tsai 、Yu-Wei Chen 、Tze-Wah Kao、Kuan-Hung Lin、Chien-Hua-Tseng、Li-Chin-Sung、Yu-Chen Ko

【SKMH】Chu-Lin Chou

Chief：Mai-Szu Wu (President, TMU)、Chih-Cheng Hsu (Professor, NHRI)、Ruei-Ming Chen、Shing-Hwa Lu、Yung-Ho Hsu

Agenda：

1. **Progress report on the renal and urinary precision health plan and biological sample database**
2. **Chronic Kidney Disease Team**
3. **rology Innovation Technology and Surgical Team**

臺北醫學大學
TAIPEI MEDICAL UNIVERSITY

臺北醫學大學
泌尿腎臟研究中心
TMU Research Center of Urology and Kidney

腎臟泌尿精準健康計畫及生物檢體資料庫進度報告

報告人：吳逸文 副教授

114年7月24日

腎病精準醫學計畫：改變疾病照護策略，實現數位精準管理

S1 建立精準照護流程

S2 培育基因專業人才

S3 驗證精準照護效益

【基因檢測】建立檢體及定序流程

【基因檢測】結果判讀及報告

【基因資料庫】建立世代研究族群

【公衛環境】建立公衛及環境測值

【基因體學】基因分析人員培育與訓練

【遺傳諮詢】建立諮詢內容及訓練

【精準治療】建立基因建議介入項目

【驗證療效】確認精準檢測與預後關係

【臨床應用】數位精準管理

2024 04

2024 06

2024 12

2025 03

2025 12

2

S1 建立精準照護流程：基因檢測

2024 04

2024 10

2025 10

BIOBANK

500 WES

500 TPMI array

500 WGS (94 completed)

三共同收案

DNA: 5000 PROSPECTIVE COHORT (107 completed)

EXPOSOMES: 500 (Biobank) + 5000 (prospective cohort) (107 completed)

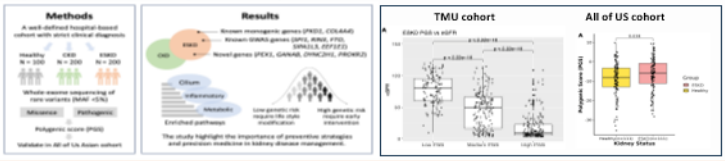
Data Sequencing & interpretation

Pathway analysis & functional annotation

Prediction model validated in external cohort

Functional genomics & Multi-omics integration

Standardized pipeline & clinical translation



- In-vitro/In-vivo study expertise
- Bioinformatics and computational science
- Industry partners
- Infrastructure

Next step

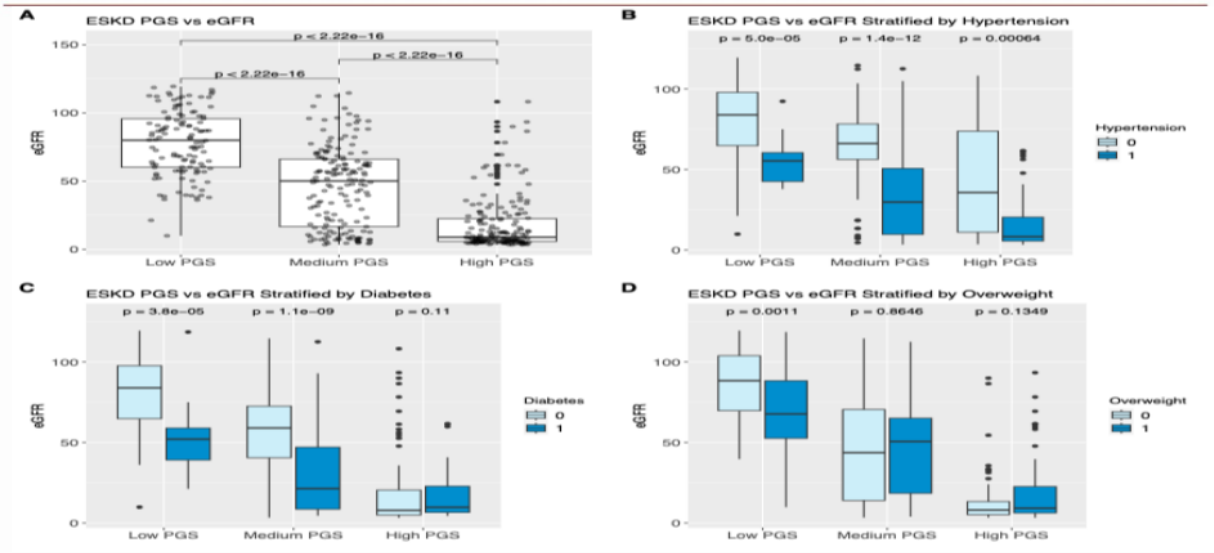
Journal Biomedical Science, under review

3

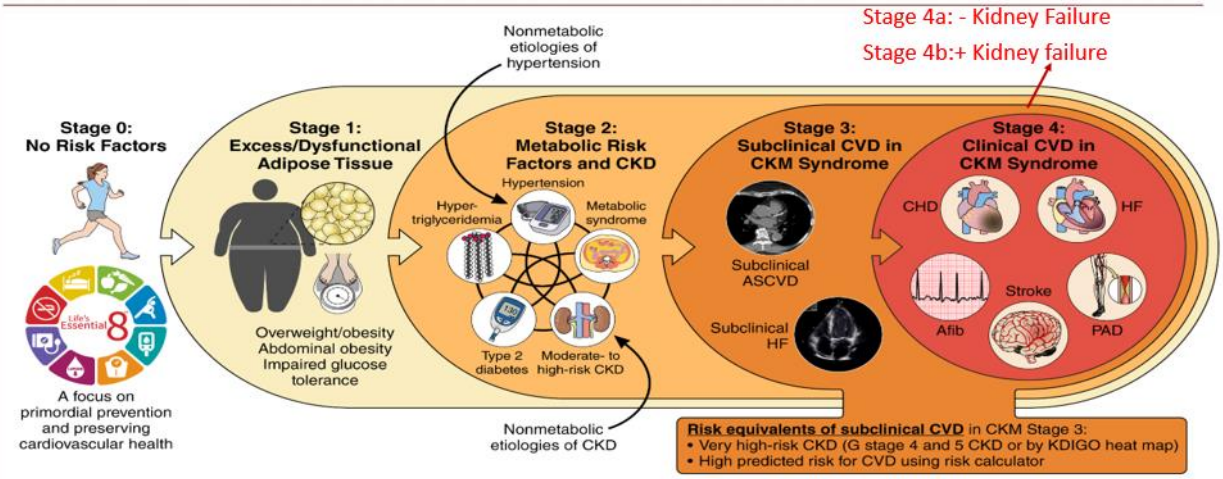
S1

建立精準照護流程：結果判讀及報告

Implication of ESKD polygenic scores according to comorbidities



Stages of Cardiovascular-Kidney-Metabolic (CKM) Syndrome



Abbreviations: Afib indicates atrial fibrillation; ASCVD, atherosclerotic cardiovascular disease; CHD, coronary heart disease; CKD, chronic kidney disease: CKM, cardiovascular-kidney-metabolic; CVD, cardiovascular disease; HF, heart failure; KDIGO, Kidney Disease Improving Global Outcomes; and PAD, peripheral artery disease.

Ndumele, C.E. et al. Circulation, 2023.

S1 建立精準照護流程：結果判讀及報告

Association between comorbidities

100 Control
200 CKD and 200 ESRD Phenotypes (N)

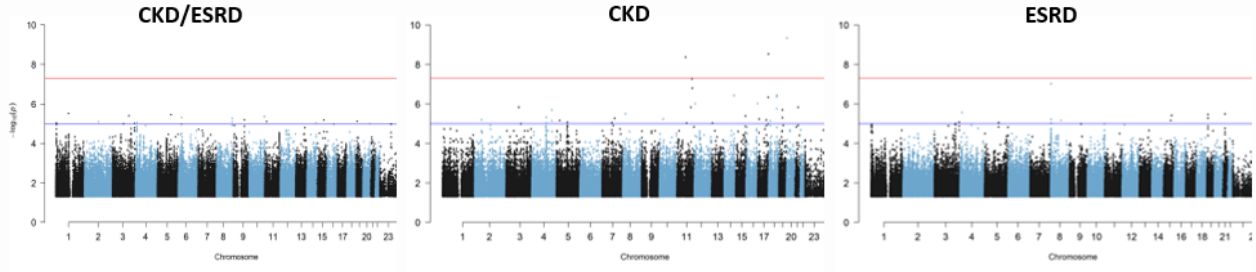
Phenotype (P)	CKD/ESRD P (Normal)	CKD/ESRD P (Disease)	Normal P (Normal)	Normal P (Disease)	p value	CKD Odds ratio	CKD 95% CI
DM	241	159 (39.75%)	97	3 (3%)	2.9E-15	21.33	6.65, 68.48
CAD	278	122 (30.5%)	97	3 (3%)	1.39E-10	14.19	4.41, 45.65
CHF	299	101 (25.25%)	99	1 (1%)	4.04E-10	33.44	4.6, 242.87
Hypertension	270	130 (32.5%)	99	1 (1%)	6.75E-14	47.67	6.58, 345.55

200 CKD and 200 ESRD Phenotypes (N)

Phenotype (P)	CKD P (Normal)	CKD P (Disease)	ESRD P (Normal)	ESRD P (Disease)	p value	CKD Odds ratio	CKD 95% CI	ESRD Odds ratio	ESRD 95% CI
DM	142	58 (29%)	99	101 (50.5%)	1.63E-05	0.4	0.27, 0.6	2.5	1.65, 3.77
CAD	174	26 (13%)	104	96 (48%)	1.85E-14	0.163	0.1, 0.27	6.135	3.76, 10.15
CHF	180	20 (10%)	119	81 (40.5%)	1.40E-12	0.164	0.09, 0.28	6.098	3.56, 10.53
Hypertension	147	53 (26.5%)	123	77 (38.5%)	1.40E-02	0.577	0.38, 0.88	1.733	1.14, 2.65

S1 建立精準照護流程：結果判讀及報告

GWAS result - diabetes



CKD cohort
p value < 1E-07

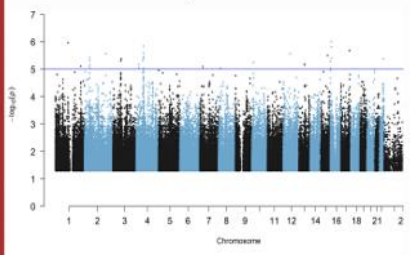
Chr	Position	Ref	Alt	Func	Gene	Gene function
11	67396261	G	A	splicing	RAD9A	Related to DNA repair; no clear studies linking to metabolic diseases
11	117188706	G	A	splicing	SIDT2	Involved in insulin resistance and lipid metabolism
17	81670455	C	T	splicing	CCDC137	No known studies supporting a pathological role in diabetes or kidney disease
20	3229093	C	A	splicing	SLC4A11	Directly involved in renal acid-base balance; associated with CKD

S1 建立精準照護流程：結果判讀及報告

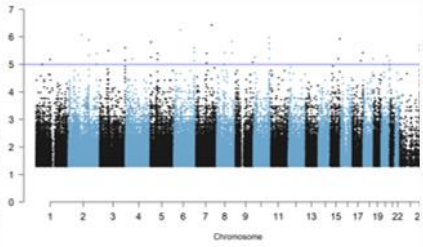
GWAS result - hypertension

- There are no markers with a p-value less than 1×10^{-7}

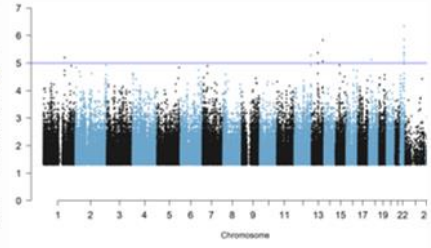
CKD/ESRD



CKD



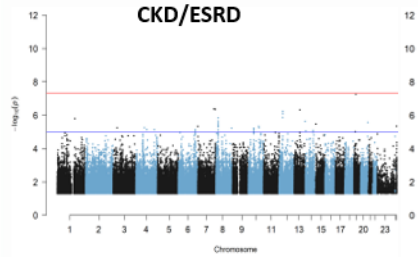
ESRD



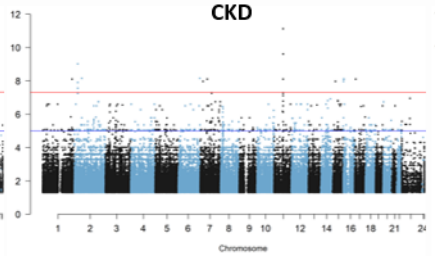
S1 建立精準照護流程：結果判讀及報告

GWAS result - coronary artery disease

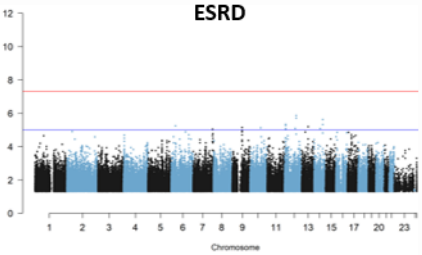
CKD/ESRD



CKD



ESRD



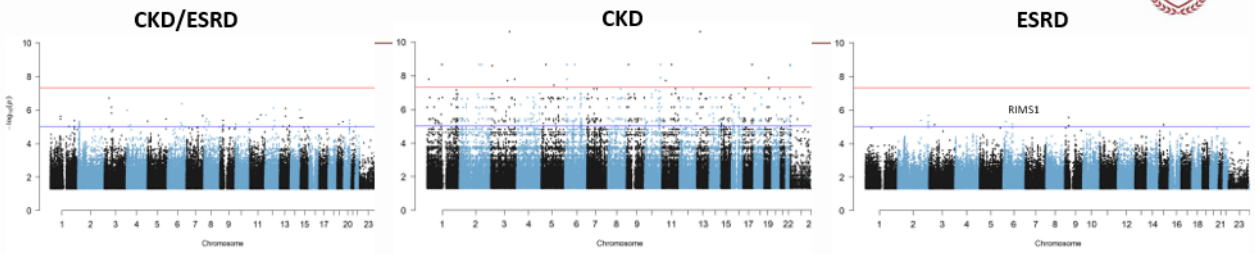
CKD cohort

Gene functions associated with CKD or CAD (p value < 1E-07)

Chr	Position	Ref	Alt	Func	Gene	Gene function
2	26746531	A	-	intergenic	KCNK3	Involved in smooth muscle excitability
16	3250975	G	A	intronic	MEFV	Inflammatory gene; causes renal amyloidosis in FMF patients
16	3250976	A	G	intronic	MEFV	
16	7192240	T	A	intronic	RBFOX1	Cardiac regulation but not directly linked to CAD
16	7196924	C	G	intronic	RBFOX1	
16	7202470	C	T	intronic	RBFOX1	
17	7839183	C	T	upstream	KDM6B	Histone demethylase involved in vascular inflammation

S1

建立精準照護流程：結果判讀及報告



GWAS result – heart failure

CKD cohort
Gene functions associated with CKD or CHF (p value < 1E-07)

Gene	Markers	Gene function
PRDM2	1	Histone methyltransferase; regulates oxidative stress in kidney tubules.
WNT3A	9	Regenerates AKI; may worsen CKD; involved in heart development/remodeling.
HRH1	1	Histamine receptor; modulates vascular tone and kidney/heart responses.
ATG7	1	Autophagy gene; protects kidney tubules and heart cells from dysfunction.
DIPK2A	1	Expressed in kidney; promotes heart cell growth via PI3K/AKT/CDK7.
NADK2	1	Mitochondrial NAD kinase; key for redox metabolism.
JARID2	5	Regulates heart development via PRC2-NOTCH1; deletion causes defects.
POM121L12	1	Nucleoporin-like; linked to kidney cancer and vessel function.
PTPN12	4	Tyrosine phosphatase; regulates HERG channel and endothelial autophagy.
YWHAZ	1	Signaling adaptor; affects renal cancer, insulin pathway, and cardiac stress.
GPR26	10	Orphan GPCR; protects monocytes in T2D-related inflammation.
KCNA4	1	Cardiac K⁺ channel (Kv1.4); regulates action potentials; down in heart failure.
FSHB	1	Pituitary hormone; may promote cyst growth in ADPKD.
ENOX1	1	NADH oxidase; essential for blood vessel formation.
ABCA5	2	Cholesterol transporter; KO causes cardiomyopathy in mice.
CEP89	1	Needed for cilia and mitochondria; linked to polycystic kidney disease.
MIR3201	2	MicroRNA involved in diabetic heart dysfunction.

S2

培育基因專業人才

One campus: 共同收案，共享資料，共同發表

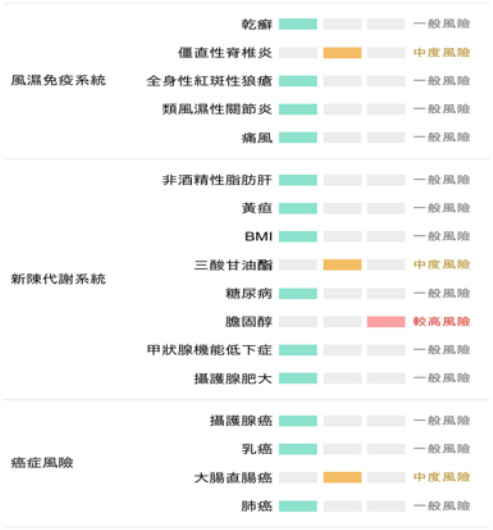
- **Genomic Cohort Establishment**

吳逸文/高治圻	廖家德/林冠宏	吳岳霖
IgA nephropathy	Polycystic kidney disease Diabetic kidney disease	Other kidney disease

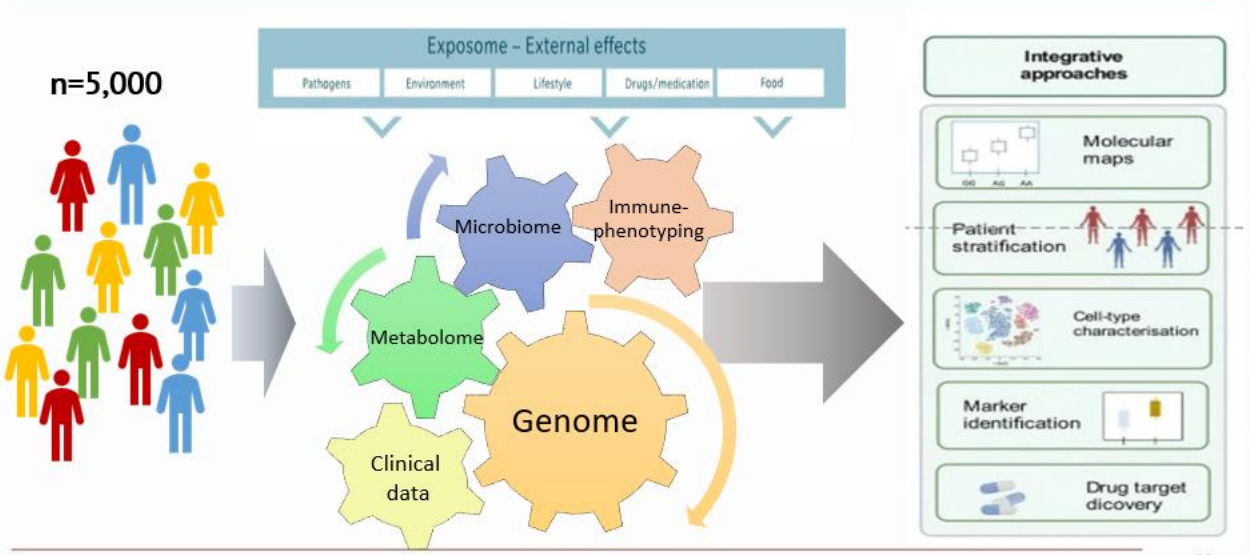
- Prospective cohort with repeated measurement
- **Outcome:** rapid renal progression (eGFR decline > 50 % or progression to ESKD) or occurrence of cardiovascular disease
- Exposome, multi-omic biomarker and social determinant of health

S3 驗證精準照護效益

Precision medicine: Personal Genetic Risk Report



TMU Precision Medicine Initiative for CKM syndrome: Multi-omics approach (2025-2028)



One campus: 共同收案，共享資料，共同發表

- **Prospective Genomic Cohort Establishment:** Prospective cohort: 106

高治圻/吳逸文	廖家德/林冠宏	吳岳霖
IgA nephropathy	Polycystic kidney disease	Other kidney disease

年度	月份	腎臟科_雙和_血液	腎臟科_附醫_血液	腎臟科_萬芳_血液
2024	7	0	1	0
2024	8	0	2	0
2024	9	0	7	0
2024	10	0	13	0
2024	11	0	11	0
2024	12	0	18	0
2025	1	0	12	0
2025	2	0	4	1
2025	3	2	10	0
2025	4	1	17	1
2025	5	0	11	0
2025	6	0	13	0
2025	7			

目前成果

- **教育部高教深耕計畫**：腎病精準醫學計畫（2024, 2025）
- **國際研討會**：台灣腎臟醫學會：台馬泰國際研討會 (2024/12)

  亞太腎臟醫學會 (2025/12)
- **國內研討會**：台基盟X國衛院：2025 精準論壇 (2025/04)
- **論文**： Polygenic Score for Kidney Function and Clinical Management through Whole-Exome Sequencing in the Taiwanese Population (審查中)
- **計畫**: 國衛院計畫：2 件（審查中）

跨領域及國際合作

Prof. Su-Hao Lo
Institute of Molecular and Genomic Medicine, NHRI
Functional studies

Prof. Szu-Yuan Li
Taipei Veterans General Hospital
Epigenomics

Prof. Jung Pyo Lee
SNU-SMG Boramae Medical Center, Korea
Validation cohort

Prof. Lun-Ching Chang
Department of Mathematical Sciences, USA
Statistical Genetics

RCUK泌尿腎臟研究

CKD小組報告人：林彥仲

Topic : AI in CKD: 過去 現在 未來

114年　7月　24日

臺北醫學大學
TAIPEI MEDICAL UNIVERSITY

Progress report

TMU Research Center of Urology and Kidney (RCUK)
期中進度報告
Date: 11/21, 2020 (Saturday)
Venue: 台北大直英迪格酒店"窯廳"餐廳
Address: 台北市中山區植福路200號

Time	Topic	Speaker	Moderator
2:30-2:50		報到	
2:50-3:00	Opening remark	吳麥斯 院長	
3:00-3:30	Linking erythropoiesis to skeletal homeostasis in uremic patients	萬芳醫院 鄭仲益 醫師	萬芳醫院 蘇裕謀 主任
3:35-4:00	Artificial intelligence analysis on renal echography among patients with glomerulonephropathy	北醫附設醫院 林彥仲 醫師	
4:05-4:30	Tackling the challenging foot disease in CKD: from integrated imaging and biomarkers analysis to multidisciplinary care	雙和醫院 廖家德 醫師	
4:35 – 5:05		Break	
5:05 – 5:30	Application of laparoscopic single site surgery (LESS) in urologic disease	雙和醫院 林佳達 醫師	雙和醫院 吳佳璋 主任
5:35 – 6:00	Phimosis with disposable circumcision suture device: CirCurer	雙和醫院 高偉棠 醫師	
6:00 – 6:20	Panel discussion		許永和院長 陳冠州教授
6:30 ~		Dinner	

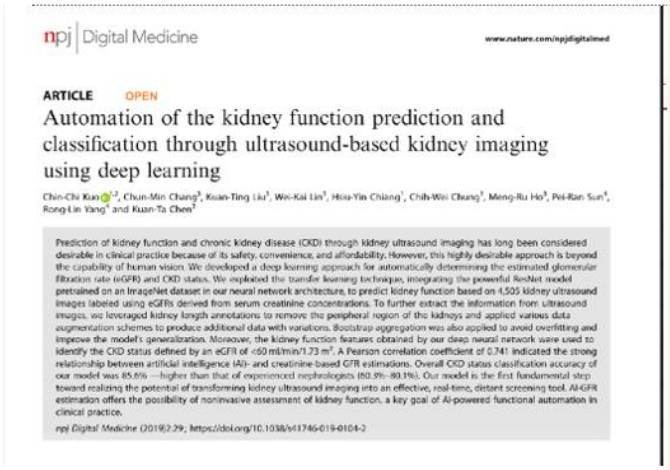
臺北醫學大學 TAIPEI MEDICAL UNIVERSITY

111年度【臺北醫學大學暨國立臺灣科技大學學術合作專題研究計畫□
經費核定清單

計 畫 名 稱： 腎臟超音波人工智慧模型預測慢性腎臟發炎程度
計畫編號： TMU-NTUST-111-08
計畫主持人： 林彥仲副教授 機構及單位： 臺北醫學大學內科學科
計畫主持人： 沈哲州教授 機構及單位： 臺灣科技大學電機工程系
計畫補助經費： 合計400,000元（兩校各補助200,000元）

補助項目	核定金額(元)	備註
業務費		臺北醫學大學 60000 元 臺灣科技大學 元(請列明細) - 於111年12月12日前完成請購核銷，若逾期則視同放棄此經費補助。
人事費		臺北醫學大學 120000 元 國立臺灣科技大學 元(以下項目請詳填) □勞雇型兼專助理，_____元 ＊(需含投保單位勞保勞退健保費用) □研究獎助生，_____元 博士生： 元/月＊ 人 碩士生： 10000 元/*12月 1人 大學生： 元/月＊ 人
研究設備費		臺灣科技大學 元(請列明細) - 於111年9月30日前完成請購，11月30日前完成核銷，若逾期則視同放棄此經費補助。
管理費	20,000	臺北醫學大學 20,000 元
合計	400,000	臺北醫學大學 200,000 元 臺灣科技大學 200,000 元

臺北醫學大學 TAIPEI MEDICAL UNIVERSITY



npj | Digital Medicine

www.nature.com/npjdigitalmed

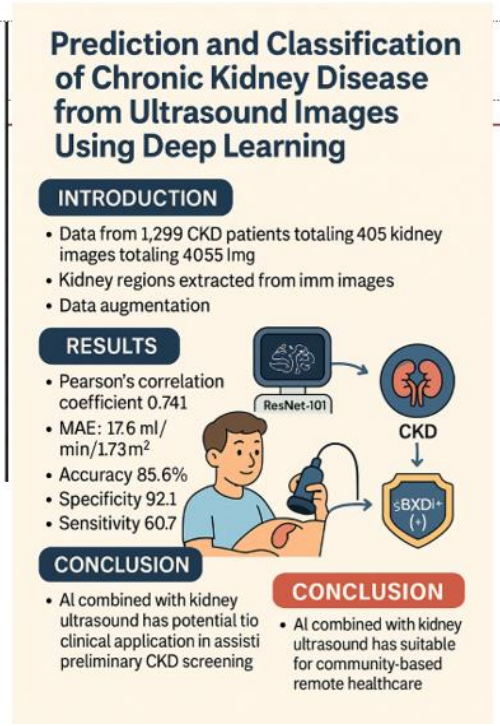
ARTICLE OPEN

Automation of the kidney function prediction and classification through ultrasound-based kidney imaging using deep learning

Chin-Chi Kuo[1,2], Chun-Min Chang[3], Kuan-Ting Liu[3], Wei-Kai Lin[3], Hsiu-Yin Chiang[3], Chih-Wei Chung[3], Meng-Ru Ho[3], Pei-Ran Sun[4], Rong-Lin Yang[3] and Kuan-Ta Chen[3]

Prediction of kidney function and chronic kidney disease (CKD) through kidney ultrasound imaging has long been considered desirable in clinical practice because of its safety, convenience, and affordability. However, this highly desirable approach is beyond the capability of human vision. We developed a deep learning approach for automatically determining the estimated glomerular filtration rate (eGFR) and CKD status. We exploited the transfer learning technique, integrating the powerful ResNet model pretrained on an ImageNet dataset in our neural network architecture, to predict kidney function based on 4,505 kidney ultrasound images labeled using eGFRs derived from serum creatinine concentrations. To further extract the information from ultrasound images, we leveraged kidney length annotations to remove the peripheral region of the kidneys and applied various data augmentation schemes to produce additional data with variations. Bootstrap aggregation was also applied to avoid overfitting and improve the model's generalization. Moreover, the kidney function features obtained by our deep neural network were used to identify the CKD status defined by an eGFR of <60 ml/min/1.73 m². A Pearson correlation coefficient of 0.741 indicated the strong relationship between artificial intelligence (AI)- and creatinine-based GFR estimations. Overall CKD status classification accuracy of our model was 85.6% —higher than that of experienced nephrologists (60.8%–80.3%). Our model is the first fundamental step toward realizing the potential of transforming kidney ultrasound imaging into an effective, real-time, dietant screening tool. AI-GFR estimation offers the possibility of noninvasive assessment of kidney function, a key goal of AI-powered functional automation in clinical practice.

npj Digital Medicine (2019)2:29; https://doi.org/10.1038/s41746-019-0104-2



臺北醫學大學 TAIPEI MEDICAL UNIVERSITY

人工智慧預測間質纖維化及腎小管萎縮

- AI 預測腎臟間質纖維化與腎小管萎縮（IFTA）
- 結合超音波影像與生物標記BMJ Health Care Informatics 2025

臺北醫學大學 TAIPEI MEDICAL UNIVERSITY

研究背景與目的

- • CKD 患病率高，IFTA 是重要預後指標
- • 傳統需腎切片，具侵入性
- • 本研究結合 AI + 超音波 + 生物標記
- 預測 IFTA 嚴重程度，達到非侵入性診斷

臺北醫學大學 TAIPEI MEDICAL UNIVERSITY

研究方法概要

- 對象：3家醫院共632位CKD病人 (排除糖尿病)
- • 模型輸入：腎臟US影像特徵（CNN提取）與五大生物標記 Patient biomarkers: age, sex, eGFR, serum albumin and kidney size from US reports.
- • 使用模型：Logistic 回歸、XGBoost、LightGBM
- • 評估：5-fold cross-validation+ AUROC + F1scores

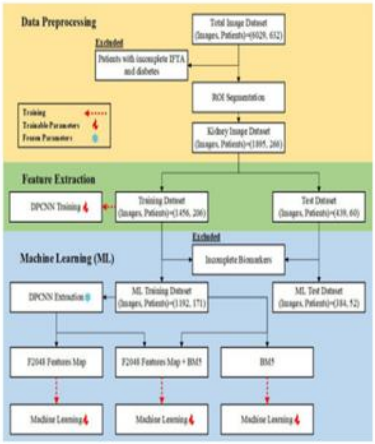


Figure 1 Overall classification pipeline F2048 represents

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結果摘要

- eGFR 單獨 AUROC 0.87
- 影像特徵 AUROC 0.91
- 生物標記 AUROC 0.95（病人層級）
- 結合影像+生物標記 AUROC 高達 0.99
- 生物標記已足夠，影像資訊未明顯提升效能

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Table 3 Image-level and patient-level evaluation metrics of logistic regression.

	Image level		Patient level		
	F2048+BM5	F2048	F2048+BM5	F2048	BM5
Accuracy	0.93	0.78	0.88	0.81	0.87
Precision	0.98	0.84	0.92	1	0.88
Recall	0.85	0.54	0.85	0.62	0.85
F1 score	0.91	0.66	0.88	0.76	0.86
AUROC	0.99	0.86	0.96	0.93	0.92
P value	Ref	<0.01	Ref	0.60	0.07

F2048 represents a 2048-dimension feature vector from the feature extractor and BM5 represents five key biomarkers. The p value denotes the result of the DeLong test, which compares the performance differences between different feature sets.
AUROC, area under the receiver operating characteristic curve.

臨床意涵與未來方向

- 建立非侵入性 IFTA 評估工具，提升早期偵測能力
- • 減少不必要的腎切片
- • 未來需驗證外部族群與加入預後追蹤

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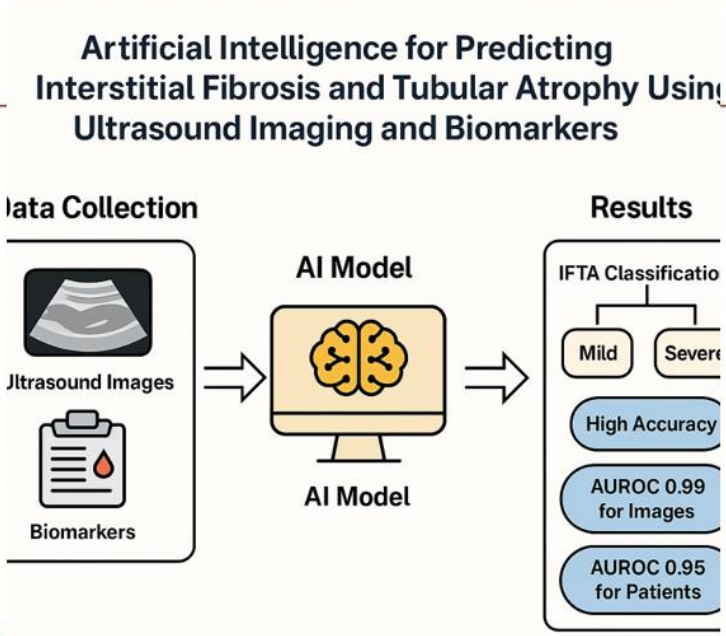
Graphic abstract



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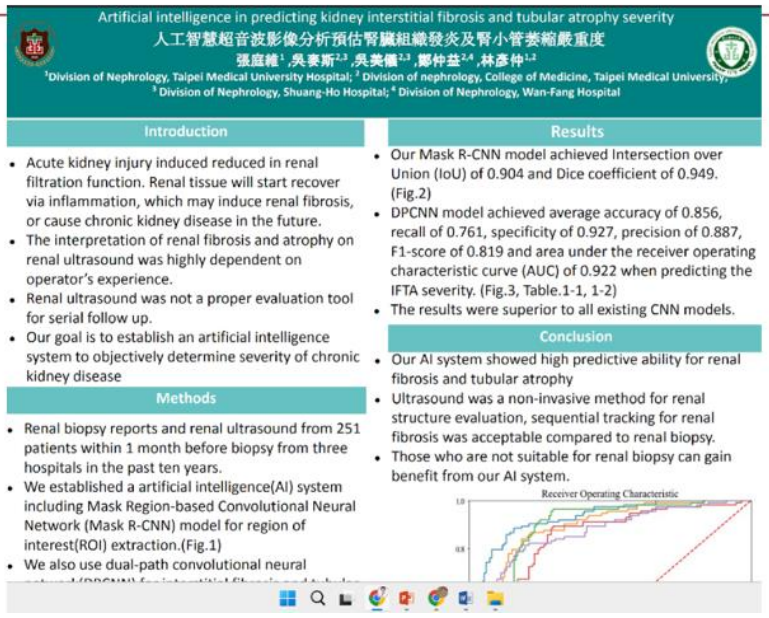
Poster TSN 2024



Artificial intelligence in predicting kidney interstitial fibrosis and tubular atrophy severity

人工智慧超音波影像分析預估腎臟組織發炎及腎小管萎縮嚴重度

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Introduction

- Acute kidney injury induced reduced in renal filtration function. Renal tissue will start recover via inflammation, which may induce renal fibrosis, or cause chronic kidney disease in the future.
- The interpretation of renal fibrosis and atrophy on renal ultrasound was highly dependent on operator's experience.
- Renal ultrasound was not a proper evaluation tool for serial follow up.
- Our goal is to establish an artificial intelligence system to objectively determine severity of chronic kidney disease

Methods

- Renal biopsy reports and renal ultrasound from 251 patients within 1 month before biopsy from three hospitals in the past ten years.
- We established a artificial intelligence(AI) system including Mask Region-based Convolutional Neural Network (Mask R-CNN) model for region of interest(ROI) extraction.(Fig.1)
- We also use dual-path convolutional neural

Results

- Our Mask R-CNN model achieved Intersection over Union (IoU) of 0.904 and Dice coefficient of 0.949. (Fig.2)
- DPCNN model achieved average accuracy of 0.856, recall of 0.761, specificity of 0.927, precision of 0.887, F1-score of 0.819 and area under the receiver operating characteristic curve (AUC) of 0.922 when predicting the IFTA severity. (Fig.3, Table.1-1, 1-2)
- The results were superior to all existing CNN models.

Conclusion

- Our AI system showed high predictive ability for renal fibrosis and tubular atrophy
- Ultrasound was a non-invasive method for renal structure evaluation, sequential tracking for renal fibrosis was acceptable compared to renal biopsy.
- Those who are not suitable for renal biopsy can gain benefit from our AI system.

Receiver Operating Characteristic

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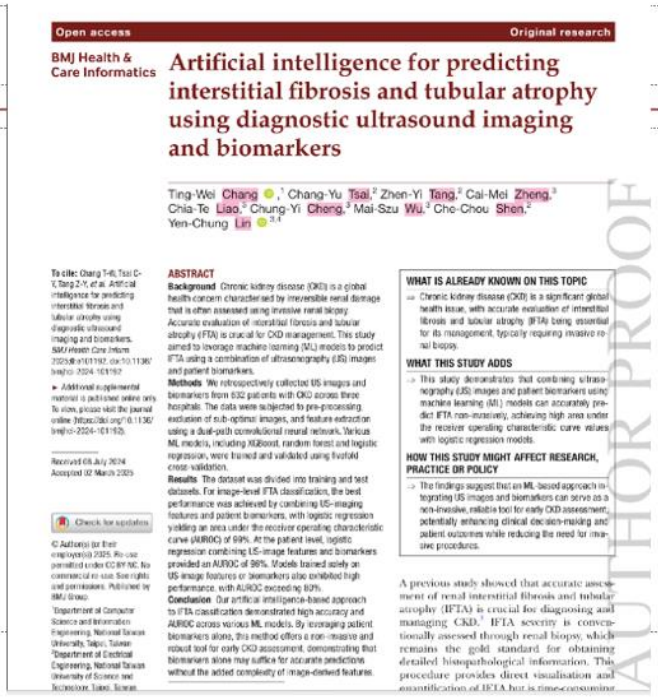

Open access Original research

BMJ Health & Care Informatics

Artificial intelligence for predicting interstitial fibrosis and tubular atrophy using diagnostic ultrasound imaging and biomarkers

Ting-Wei Chang ,[1] Chang-Yu Tsai,[2] Zhen-Yi Tang,[2] Cai-Mei Zheng,[3] Chia-Te Liao,[2] Chung-Yi Cheng,[3] Mai-Szu Wu,[2] Che-Chou Shen,[2] Yen-Chung Lin [3,4]

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ABSTRACT

Background Chronic kidney disease (CKD) is a global health concern characterised by irreversible renal damage that is often assessed using invasive renal biopsy. Accurate evaluation of interstitial fibrosis and tubular atrophy (IFTA) is crucial for CKD management. This study aimed to leverage machine learning (ML) models to predict IFTA using a combination of ultrasonography (US) images and patient biomarkers.

Methods We retrospectively collected US images and biomarkers from 632 patients with CKD across three hospitals. The data were subjected to pre-processing, exclusion of sub-optimal images, and feature extraction using a dual-path convolutional neural network. Various ML models, including XGBoost, random forest and logistic regression, were trained and validated using fivefold cross-validation.

Results The dataset was divided into training and test datasets. For image-level IFTA classification, the best performance was achieved by combining US-imaging features and patient biomarkers, with logistic regression yielding an area under the receiver operating characteristic curve (AUROC) of 89%. At the patient level, logistic regression combining US-image features and biomarkers provided an AUROC of 96%. Models trained solely on US-image features or biomarkers also exhibited high performance, with AUROC exceeding 80%.

Conclusion Our artificial intelligence-based approach to IFTA classification demonstrated high accuracy and AUROC across various ML models. By leveraging patient biomarkers alone, this method offers a non-invasive and robust tool for early CKD assessment, demonstrating that biomarkers alone may suffice for accurate predictions without the added complexity of image-derived features.

WHAT IS ALREADY KNOWN ON THIS TOPIC

→ Chronic kidney disease (CKD) is a significant global health issue, with accurate evaluation of interstitial fibrosis and tubular atrophy (IFTA) being essential for its management, typically requiring invasive renal biopsy.

WHAT THIS STUDY ADDS

→ This study demonstrates that combining ultrasonography (US) images and patient biomarkers using machine learning (ML) models can accurately predict IFTA non-invasively, achieving high area under the receiver operating characteristic curve values with logistic regression models.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

→ The findings suggest that an ML-based approach integrating US images and biomarkers can serve as a non-invasive, reliable tool for early CKD assessment, potentially enhancing clinical decision-making and patient outcomes while reducing the need for invasive procedures.

A previous study showed that accurate assessment of renal interstitial fibrosis and tubular atrophy (IFTA) is crucial for diagnosing and managing CKD.[1] IFTA severity is conventionally assessed through renal biopsy, which remains the gold standard for obtaining detailed histopathological information. This procedure provides direct visualisation and quantification of IFTA but is time-consuming

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林彥仲 主任 您好:

中華民國醫用超音波學會2025年第一次學術研討會將，擔任本次會議【 腎臟泌尿科 】超音波之 演講者。

主題：腎臟泌尿超音波			
主持人：			
時間	演講題目	演講者	服務單位
	Artificial intelligence for predicting interstitial fibrosis and tubular atrophy using diagnostic ultrasound imaging and biomarkers	林彥仲	台北醫學大學附設醫院
	Update on the Application of Ultrasonography in Understanding Autosomal Dominant Polycystic Kidney Disease	李文欽/廖上智	高雄長庚醫院
	Coffee Break		
主持人： 黃昭淵 台大醫院 黃書彬 高醫附設醫院			
	Micro-ultrasound for prostate cancer: clinical applications and future perspectives.	邱士庭	台大醫院
	Focal Therapy for early prostate cancer： current status and what we should know?	謝博帆	中國醫藥大學附設醫院

題目 Artificial intelligence for predicting interstitial fibrosis and tubular atrophy using diagnostic ultrasound imaging and biomarkers

時間 114年10月19日 星期日 上午 **約30分鐘**

地點 臺大醫學院基礎醫學大樓(台北市仁愛路一段1號)

中華民國醫用超音波學會 節目委員會
理事長 趙安祥 主任委員 楊培銘 敬邀 **114.6.13**

聯絡人：陳彩勤 小姐 Tel:02-25531757分機 11; Fax:02-25531759; 電子信箱：candyyen@url.com.tw

114年度高教深耕「轉譯創新研究計畫」經費核定清單

計畫類型：單一整合型
計畫編號：DP2-TMU-114-HIS-01
計畫名稱：人工智慧輔助以數據為中心的常見且可治療之疾病預測：超越現今電子病歷的數據
主 持 人：張君照教授〔醫學院〕
共同主持人：林聖峰副教授〔醫學院〕
林彥仲副教授〔醫學院〕
邱曉彥教授〔護理學院〕

補助項目	核定金額(元)	說 明
人事費	190,000	專任研究助理 兼任研究助理
業務費	1,010,000	實驗耗材、物品及雜項費用 臨時人員(工讀生)
合計	1,200,000	計畫執行期限：114/01/01~114/12/31 經費補助機構：臺北醫學大學

承辦人：研發處研究推動中心 黃淑穎小姐 (分機7113)

※注意事項：
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2. 專任、兼任研究助理可聘用至當年度12/31；業務費需於11/30前核銷完畢。
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5. 本計畫成果發表之論文請依規定填寫致謝詞。
致謝寫法：This work was financially supported of the Higher Education Sprout Project by the Ministry of Education (MOE) in Taiwan.
● 高教深耕計畫Higher Education Sprout Project
● 教育部Ministry of Education (MOE) in Taiwan

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MAIN OBJECTIVES OF THE RESEARCH PLAN

BLOOD PRESSURE ALERT SYSTEM

AI DRY WEIGHT ESTIMATION

BIG DATA RISK PREDICTION

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AI估算透析病患真實體重

- 在**透析治療**中，精準掌握病患「**不穿衣服的體重**」對於設定正確的脫水量至關重要。而衣物重量變化大，尤其在天氣多變、病患穿多穿少的情況下，病患穿著不同衣物上下磅，重量差異可達 1–2 公斤，可能導致 **脫水過多或不足**。

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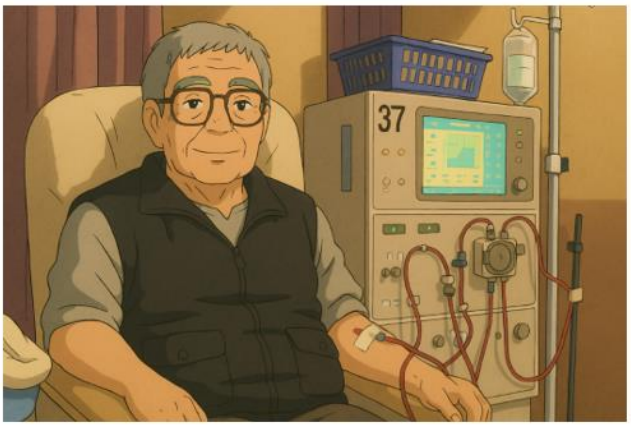
目前普遍作法

- 醫護人員目測估算
- 或根據經驗固定減重（如 0.5kg），但誤差大
- 脫水過多 ➜ 頭暈、低血壓、抽筋
- 脫水不足 ➜ 體液過多、水腫、心臟負擔



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目的

- 開發一套基於 AI 深度學習與影像辨識的系統，**透過攝影機分析衣物種類與重量**，結合體重計數據，**自動推估病患實際體重**，提升透析脫水準確性。

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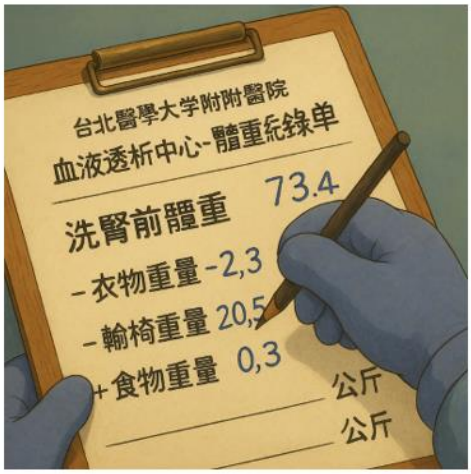
乾體重控制



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研究策略
解決方案

病患上磅 + 拍照

↓

AI模型分析衣物種類
（如：毛衣、外套、褲子）

↓

預測衣物重量

↓

自動計算推估真實體重

↓

醫護確認脫水量設定

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初期資料收集與模型訓練計畫

- **蒐集資料：**
  - 建立穿著各類服裝的樣本資料集（攝影 + 體重
  - 受試者穿不同衣服多次上磅，**提供實際衣物重**
- **訓練模型：**
  - 使用 CNN 或 Transformer 模型進行衣著辨識
  - 建立衣物 → 重量回歸模型
  - 融合環境（天氣）、病患習慣（是否常穿毛衣

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圖說：病人量完體重，數值即可透過坐式體重機上的傳輸機（如紅色箭頭所示），登錄在「電子化透析管理系統」裡。圖/東基結金球提供

台東基督教醫院「電子化透析管理系統」　7月底正式上線

【人間社記者 張武吉 台東報導】

| 2018-07-27

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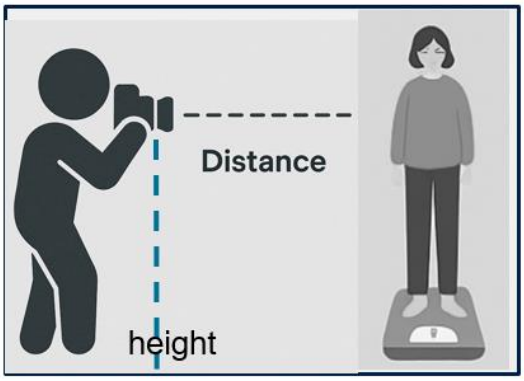
收集資料拍攝注意事項

- 相機高度、距離盡量一致
- 可拍攝正面、側面各一張
- 可以規範站立姿勢，並用固定背景或色卡輔助光源校正
- 建議拍照當下就自動秤重，減少人工誤差
- 多收集不同類型衣服（毛衣、T恤、外套、羽絨衣等）



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標記資料需要包含欄位

欄位名稱	說明
image	病人穿著衣服的照片（可考慮多角度，如正面、側面）
measured_weight	病人穿著衣服後的體重（由電子秤測得）
clothes_weight	衣服實際重量（Ground Truth，若無法取得請參考方案二）
gender	病人性別（衣著風格差異可能影響衣服重量）
height	病人身高（幫助模型理解衣服長短的比例）
~~body_shape（選填）~~	~~體型類別（如瘦、中、壯）~~太主觀
~~temperature / season~~	~~天氣或季節~~
date_time	拍照日期

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方案二

- 如果**無法拿到衣物的真實體重（ground truth）**，那我們就必須改用**間接方式建模**。因為考量病人比較不方便，**無法脫衣服再量一次，也無法直接量衣物重量**。這樣的條件下，我們可以考慮以下的方式：
- 同一病人歷次穿著**不同衣服的照片 + 體重變化**。
- 假設「**體重變動不大**」，則**不同次體重差 = 衣物差異 + 誤差**。
- 收集同一人多次資料後，用相對變化訓練模型。

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預期效益

項目	效益
脫水量精準度	誤差下降約 0.5–1.5kg
病患舒適度與安全性	顯著提升，減少不適事件
醫護工作負擔	自動化減少主觀估算
資料可視化	每次透析有完整紀錄，利於回顧與調整治療策略

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Milestones and Implementation Overview

Subproject 1
AI-Based Dry Wight Estimation

- Collect body weight and clothing data

Milestones Apply R-CNIN and XGBoost models

Subproject 2
Big Data Risk Factor Analysis for Intradialytic Hypotension

- Analyze clinical and dialysis data

Milestones
Q1: IRB appoval
Q2: Data preprocessing
Q3-Q4: AI model training

Milestones
Q1: IRB approval
Q2: Data preprocesing
Q3-Q4: AI model training

System Integration and Ciinical Application

- Develop blood pressure alert system

Q4: Prototype development

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預計收入受試者醫院
北醫
萬芳
雙和
新國民
成大

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AI model further works

1. 影像辨識與衣著分類
2. 物體重量估算的電腦視覺方法
3. 醫療應用中AI推估與實體測量相關研究
4. 資料增強與標記方法

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方法、資料與模型建議

主題	資料來源 / 技術
衣物分類與重量回歸	可參考 Clothing segmentation 與體重估算回歸文獻（如 2D image weight estimation）。
人體 shape-from-image 模型	採用 SMPL、DeepProfile、BCNet 等架構來抽取衣著外形特徵。
dry weight ML 應用	可整合 bioimpedance、血壓、化驗值等資料作多模態訓練或強化學習調整策略。
資料集構建	自建包含多樣衣著與真實秤重的試驗資料為關鍵。
模型設計	建議用多任務網路同時分類衣著、估算衣物重量與 dry weight 調整

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AI模型應用於Dry Weight預測

- 1. 隨機森林預測Dry Weight調整
- • ROC AUC約0.7，透析資料69,000筆（PubMed 37386392）
- 2. 強化學習（Dueling DDQN）減少死亡與症狀發生（PubMed 35849682）
- 3. 神經網路應用於兒童透析推估，誤差約0.5kg（PubMed 29987454）

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機器學習校正BIS體重估算

- • 結合XGBoost與臨床參數（如ECW/ICW、Alb）改善BIS偏差
- • 病患樣本數1672，預測誤差顯著下降（PMC8064601）

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影像辨識與衣物重量推估研究

- 1. 使用2D影像與XGBoost預測體重（Thesai.org）
- 2. 深度學習預測BMI，相關係數>0.93，誤差約1.2（ResearchGate）
- 3. 使用SMPL/BCNet重建穿衣3D人體形狀（arXiv）

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研究設計建議與整合策略

- • 整合衣物辨識（分類）與衣物重量預測（回歸）
- • 可使用CNN或Transformer，搭配環境/個人習慣特徵
- • 多次拍攝建立個人差異模型，或以相對變化訓練

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合作團體廠商與展望

資策會
北醫大醫學資訊所張資昊教授
奇雲國際股份有限公司Fleetivity
台科大電機工程系沈哲洲教授

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謝謝聆聽

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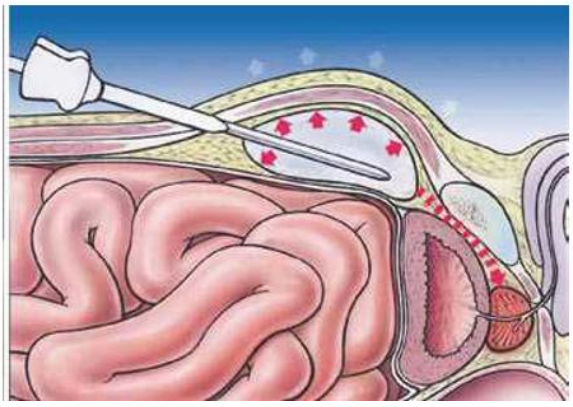
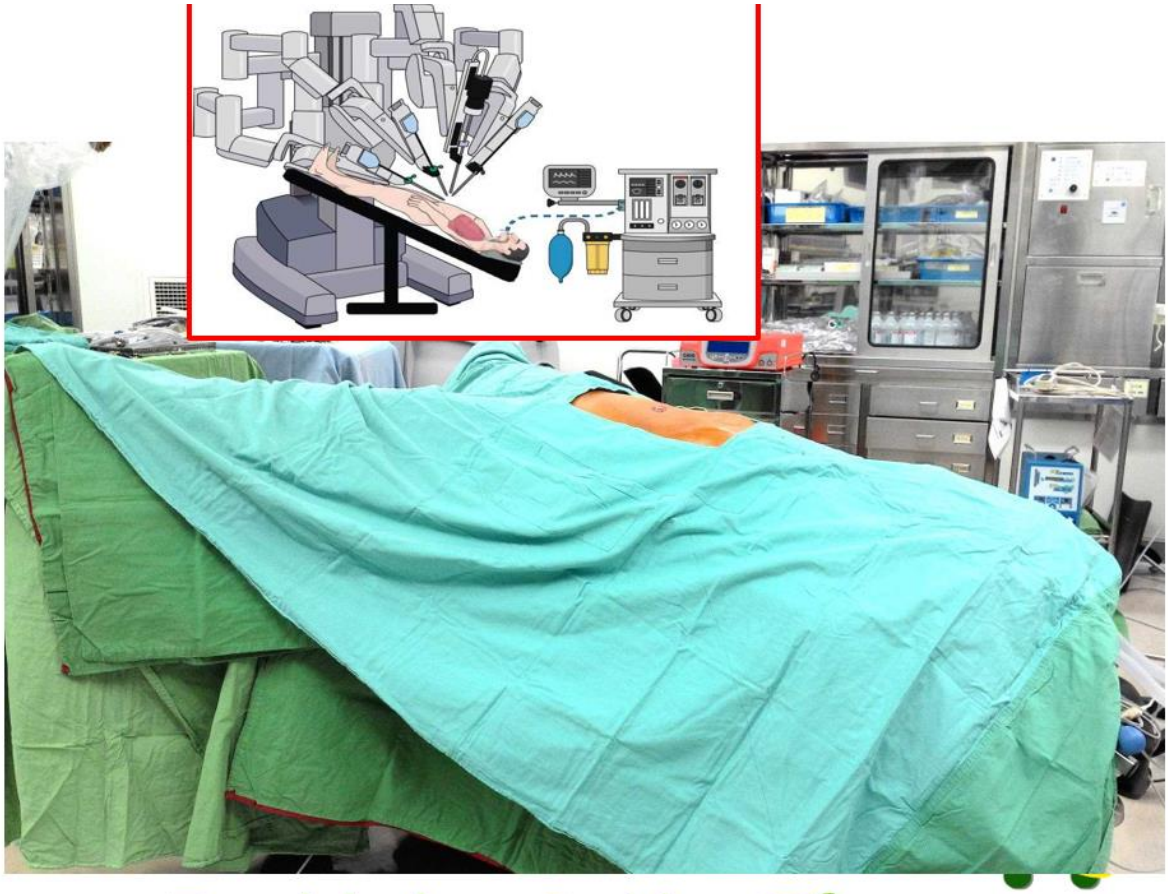
腹膜外機械手臂輔助前列腺根除手術
Extraperitoneal Robot-Assisted Radical Prostatectomy

台北醫學大學附設醫院
泌尿科 黃建榮醫師

The primary advantage:
Urine and blood are contained in the extraperitoneal space

Providing a tissue plane for **tamponade** and **preventing ileus** that can occur **when the bowel is exposed to urine** or blood.





Trendelenburg Position 30°

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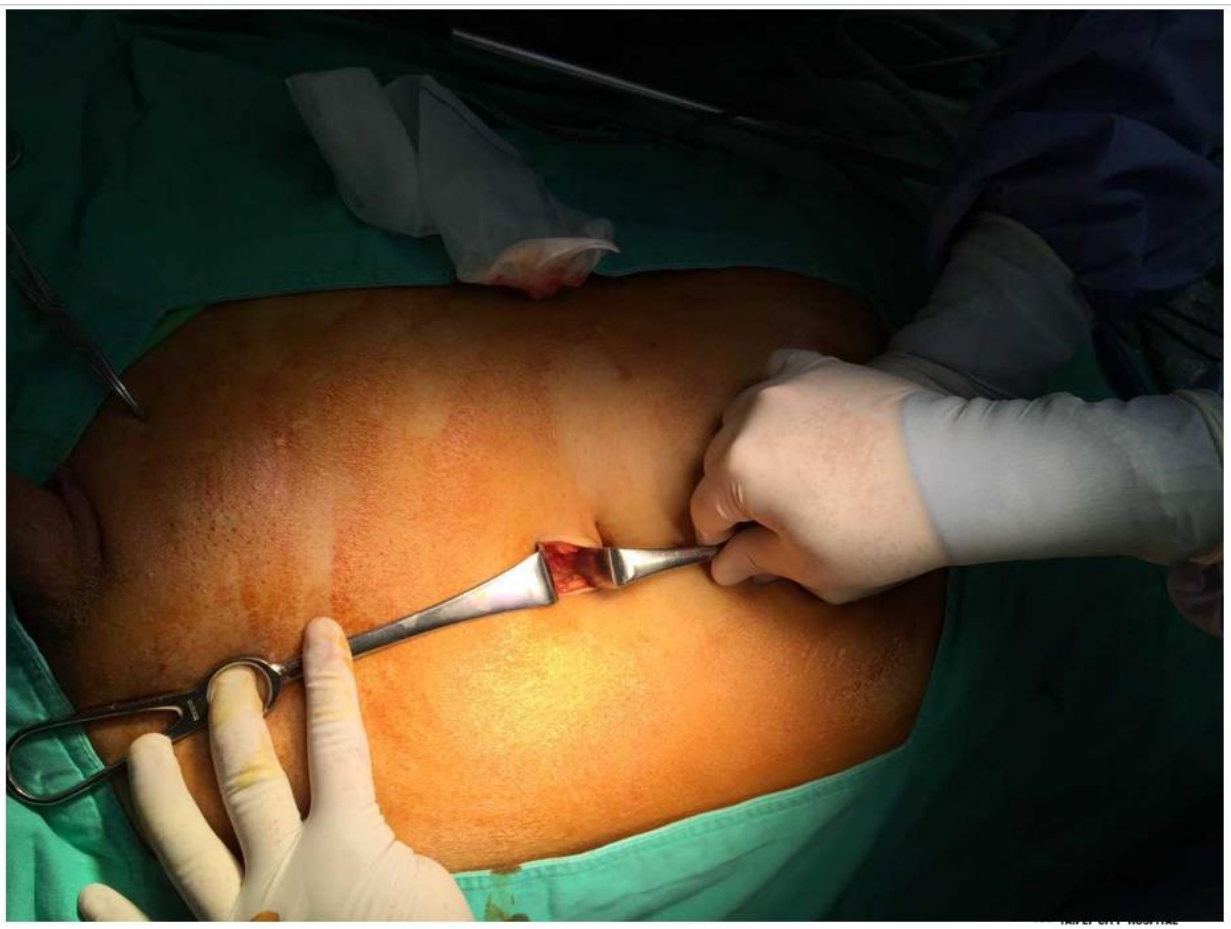

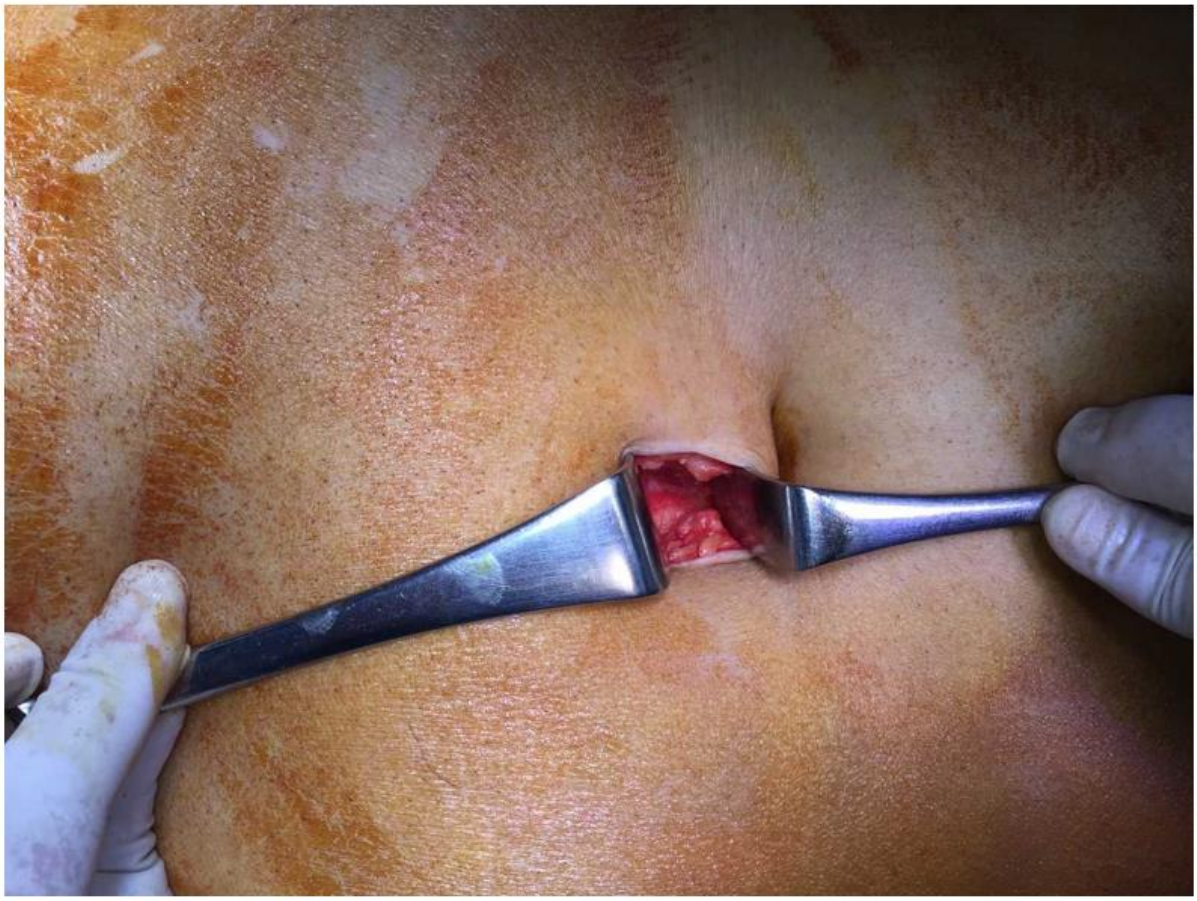

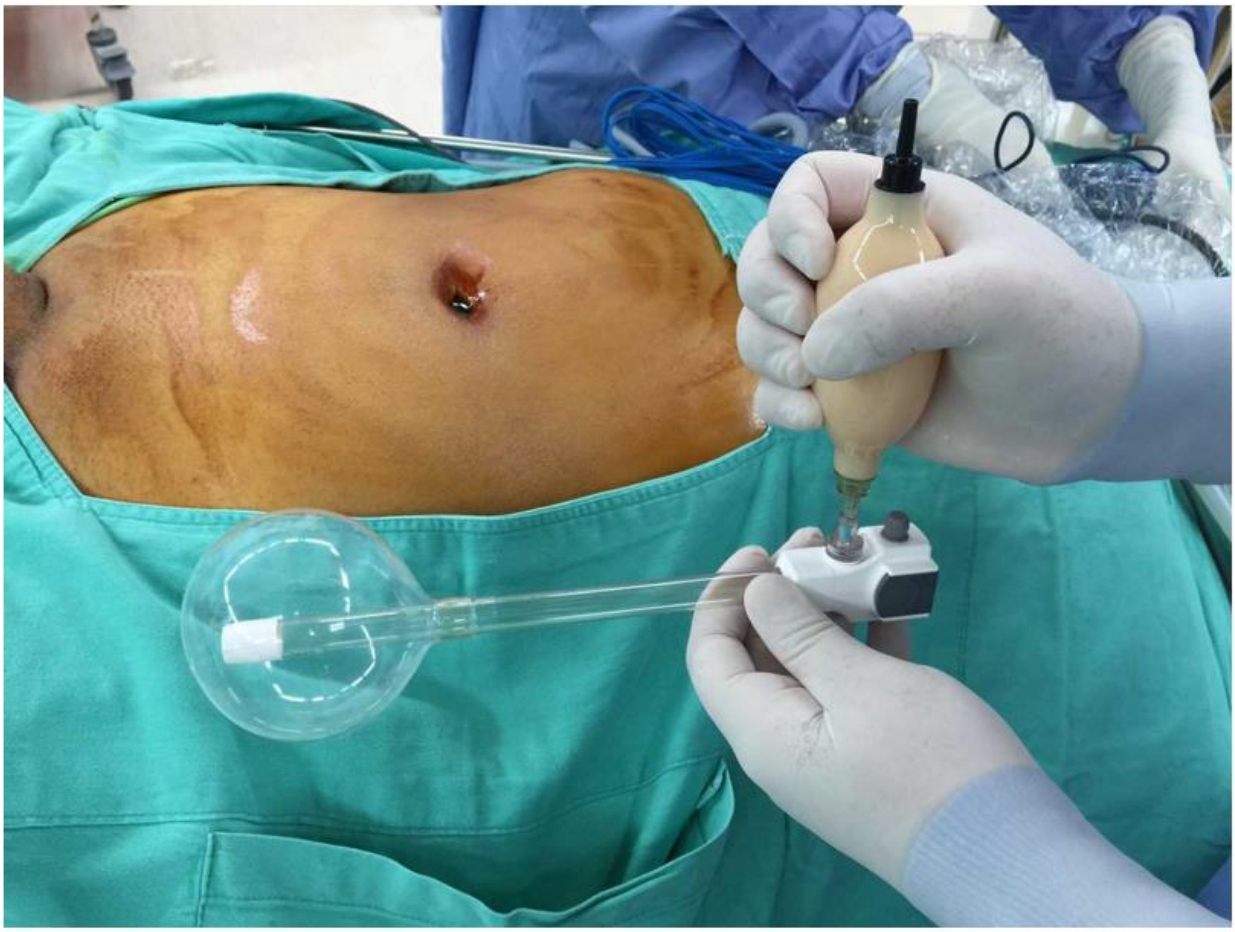

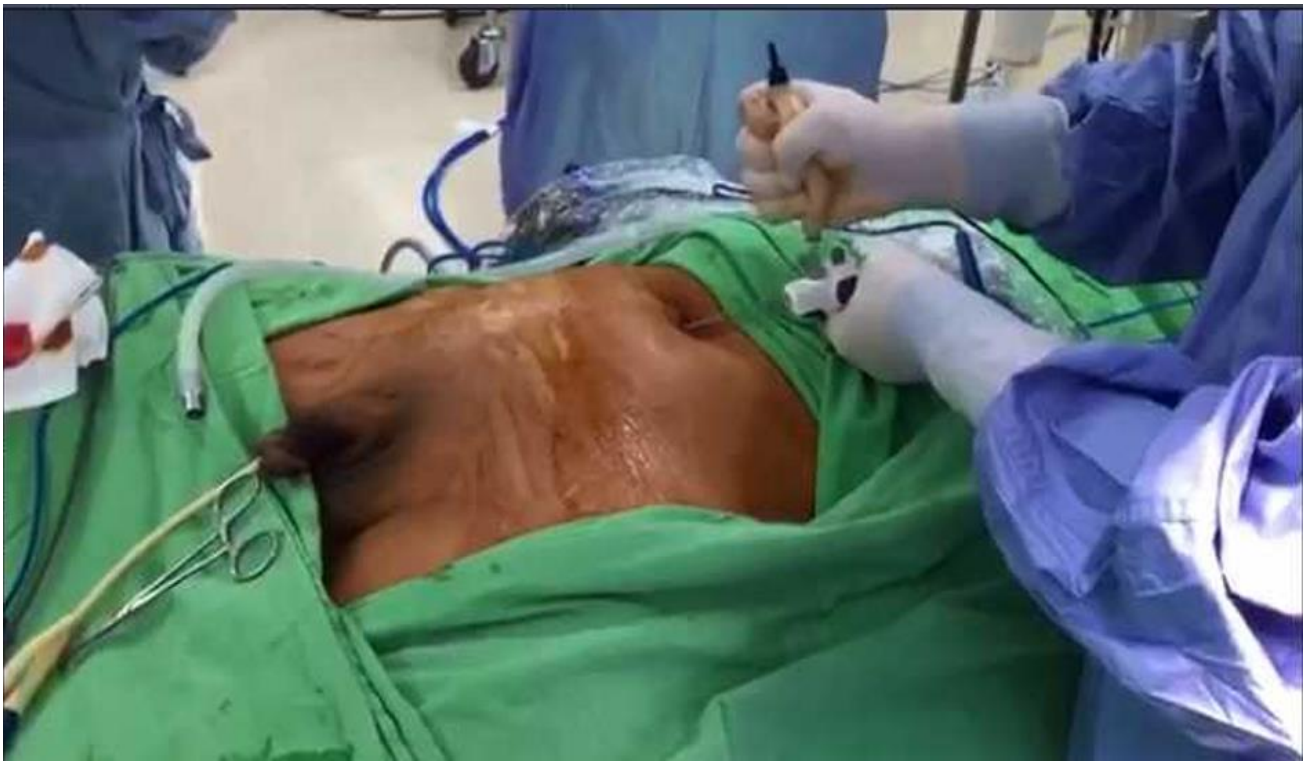

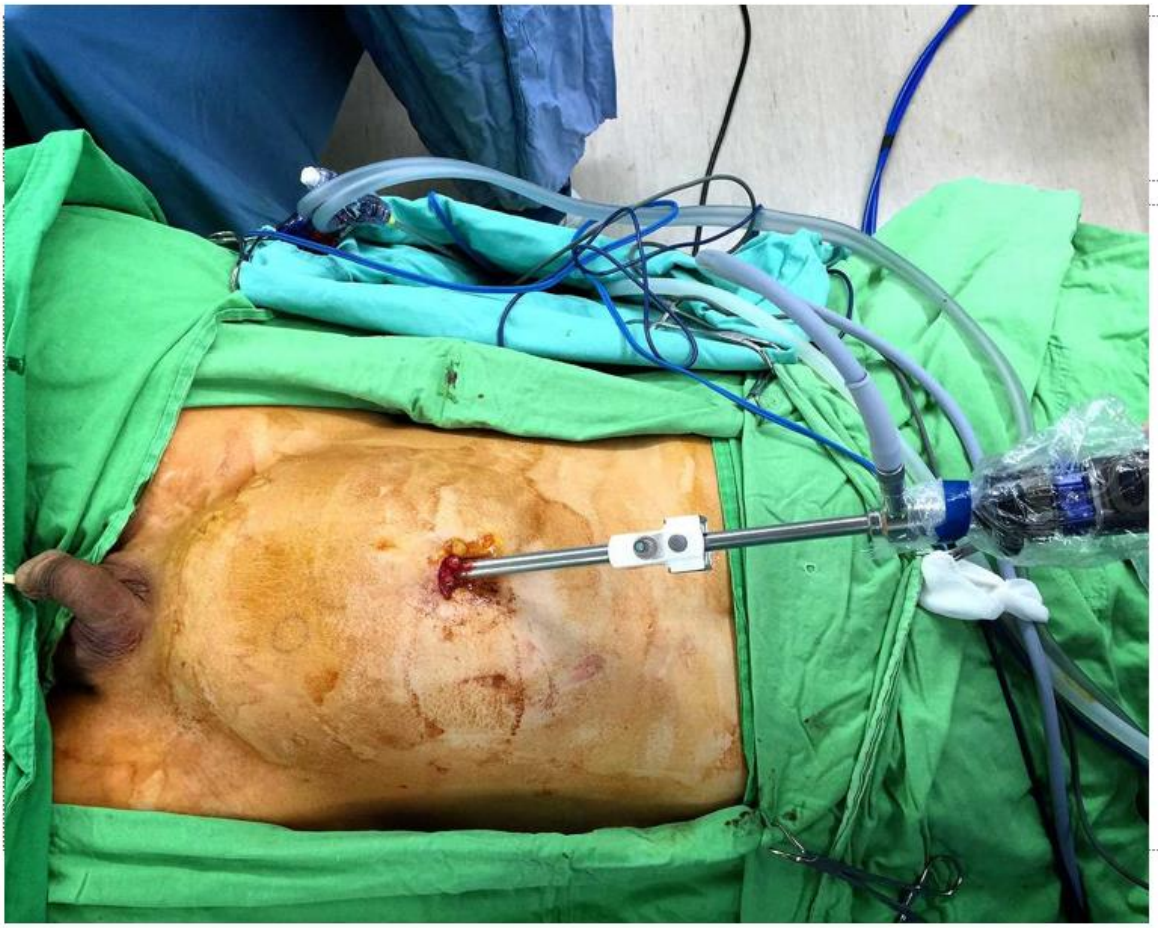

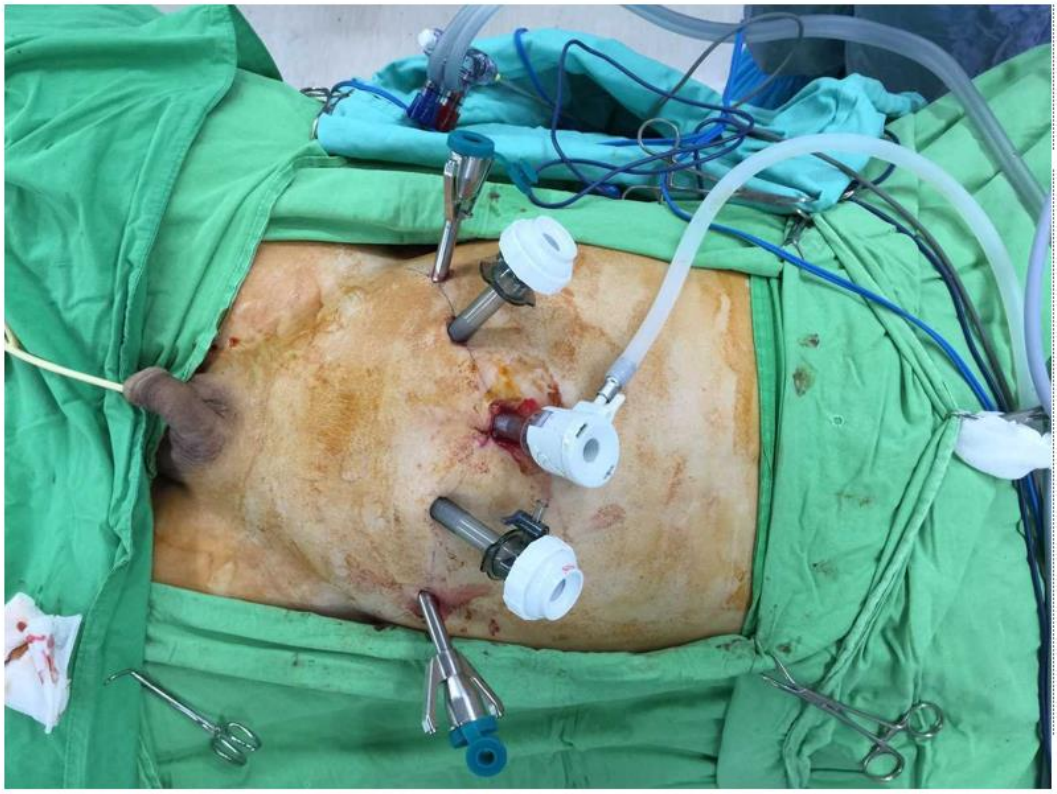

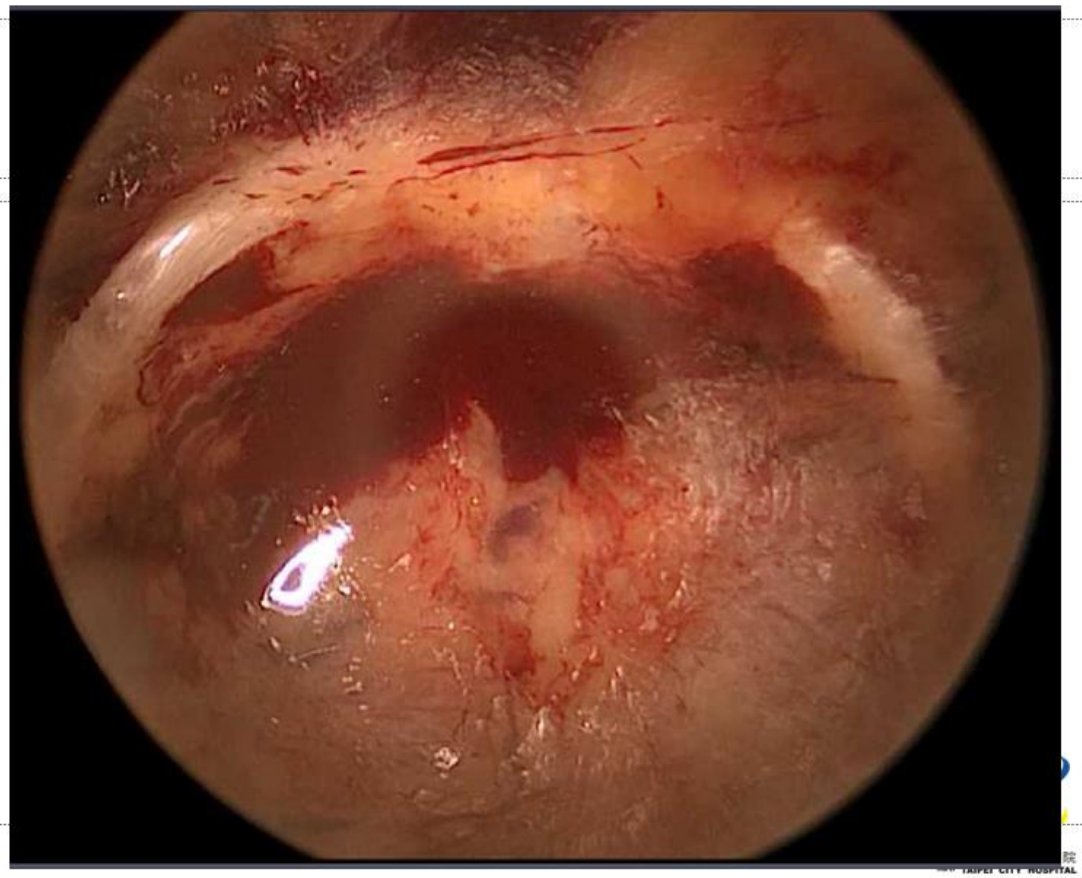
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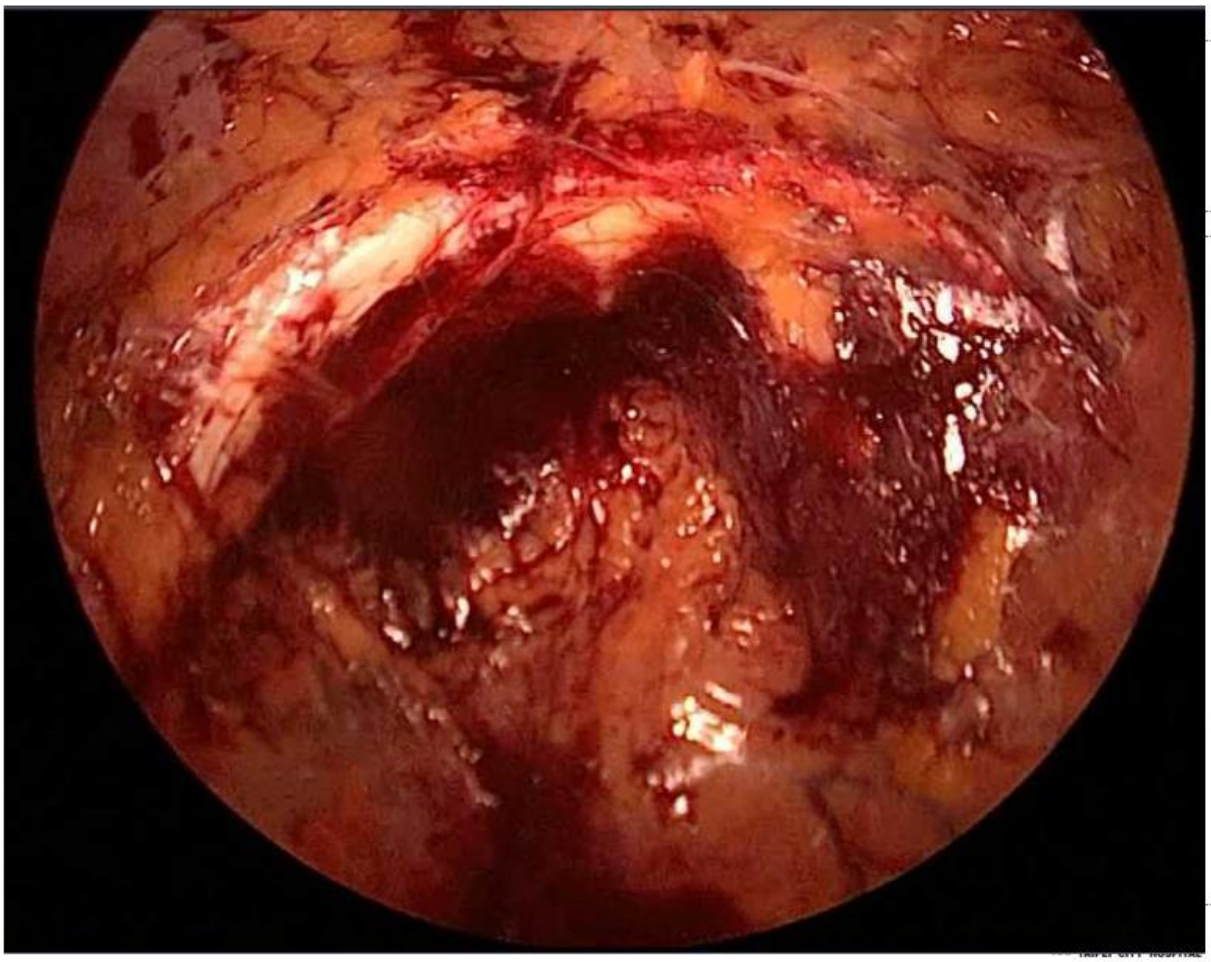

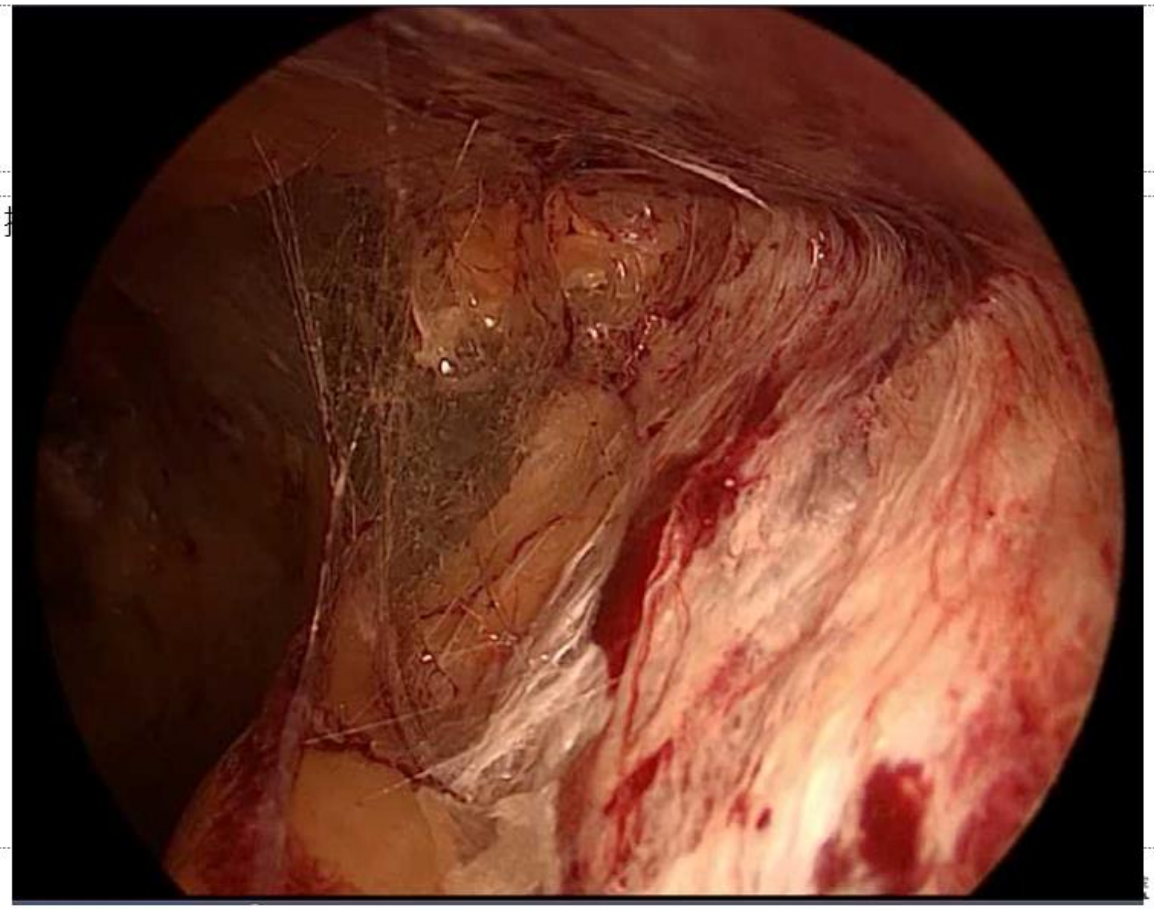

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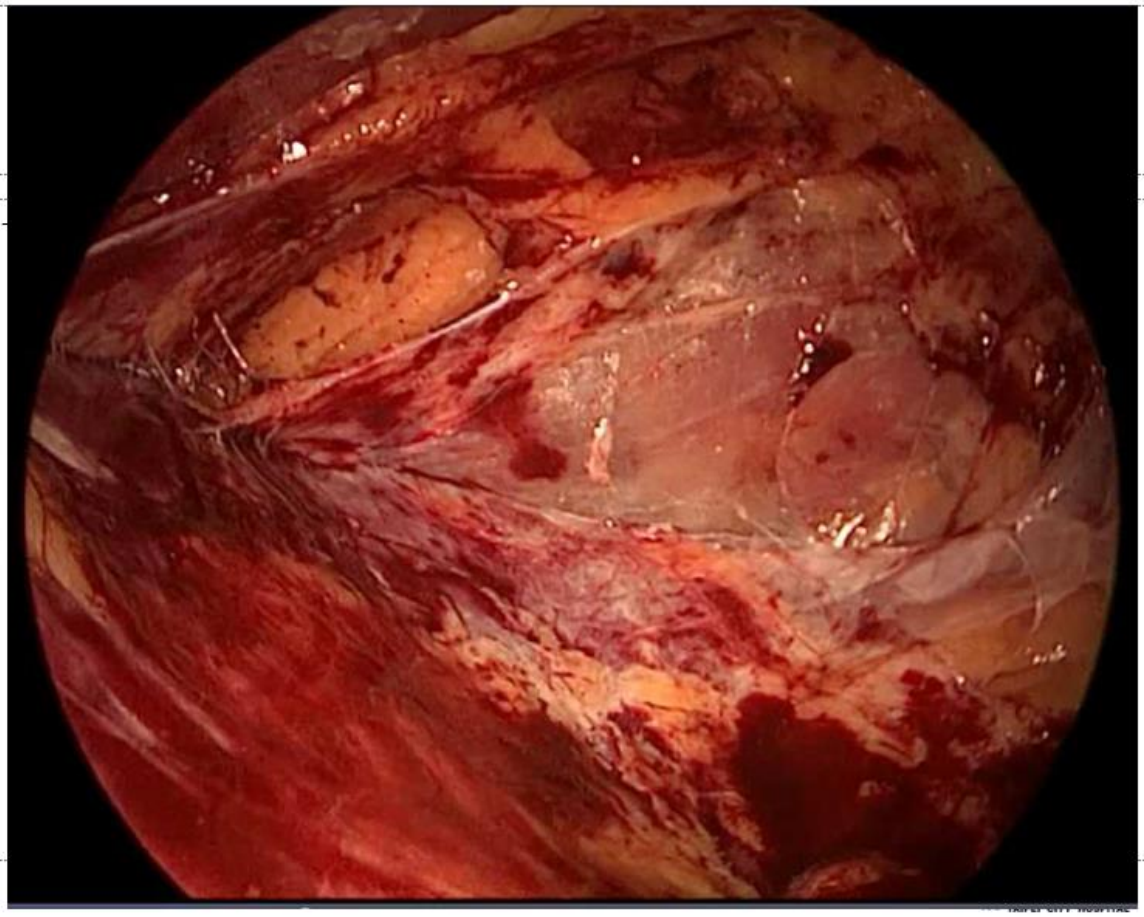

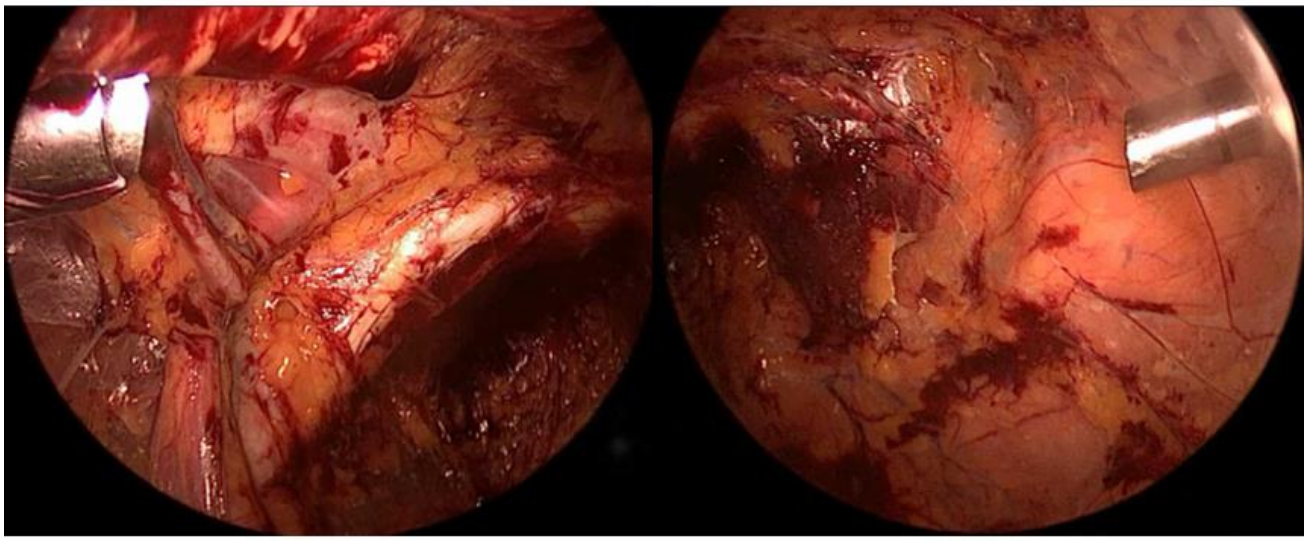

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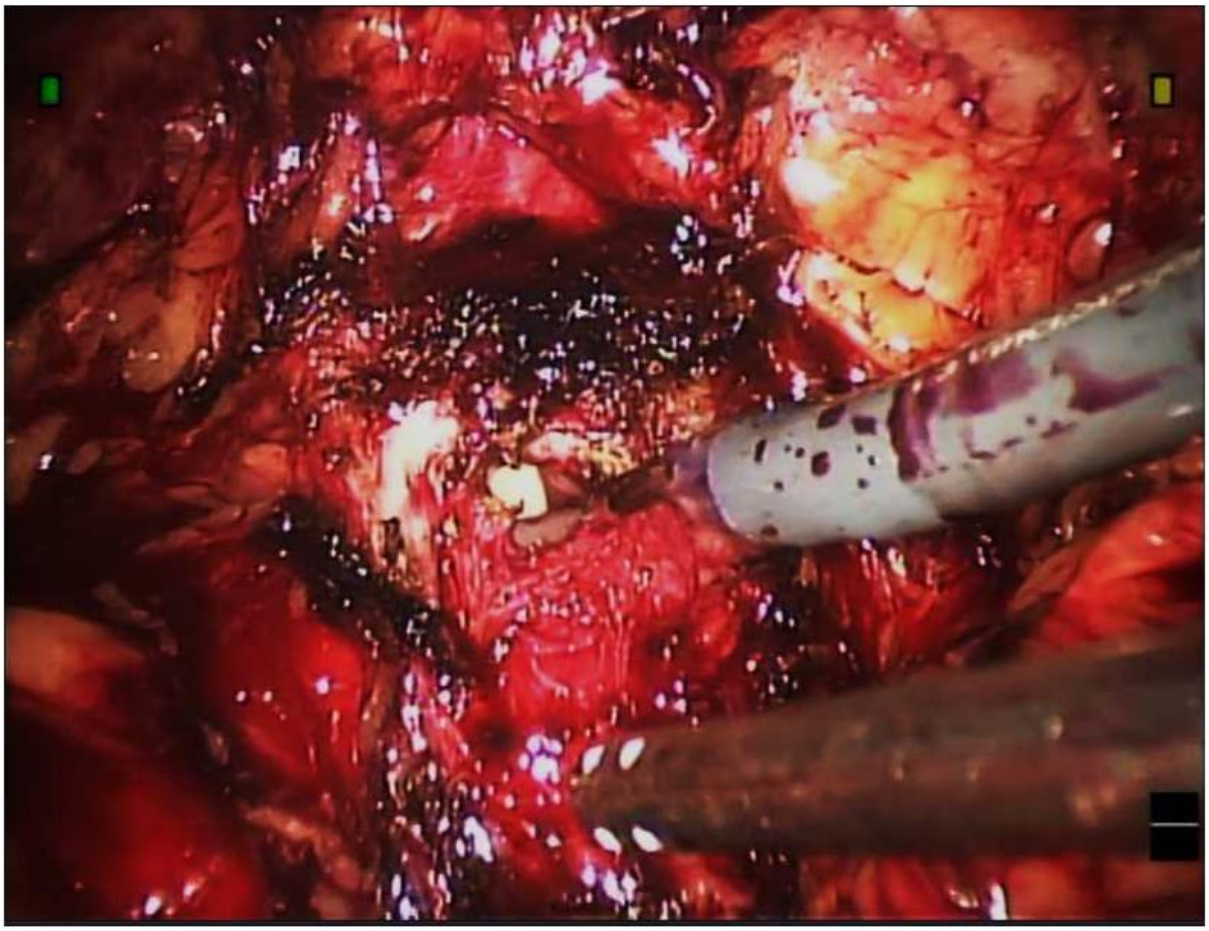
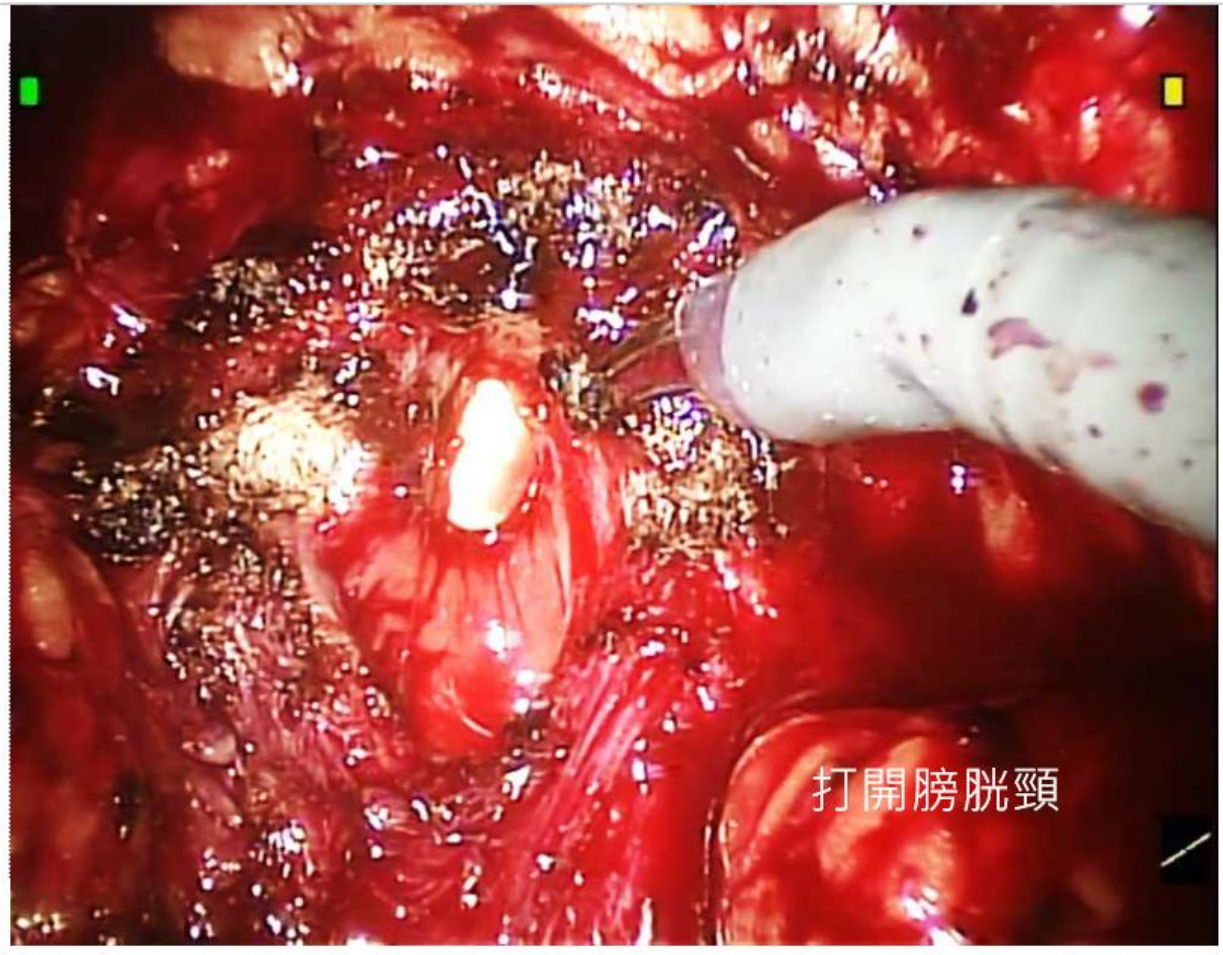
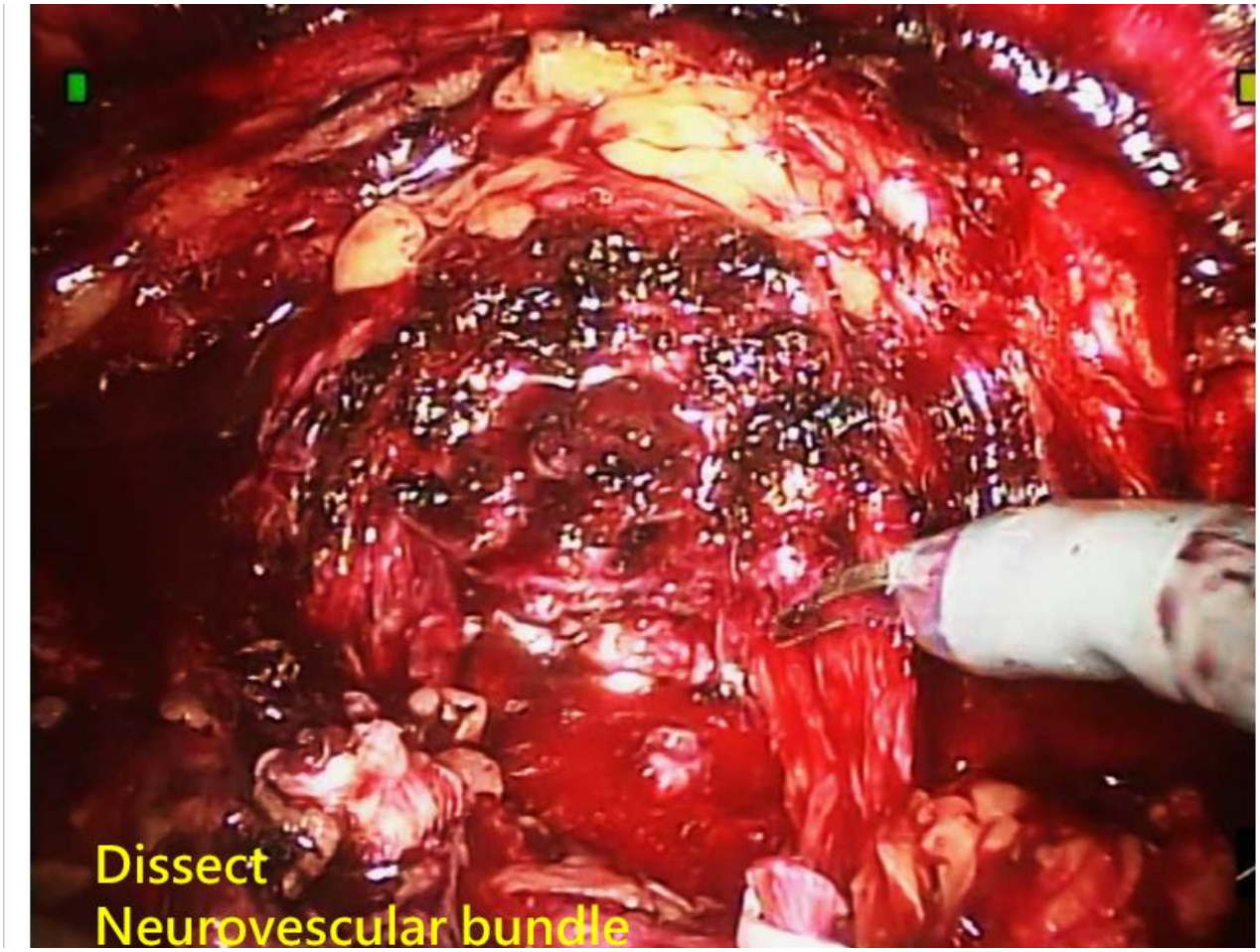
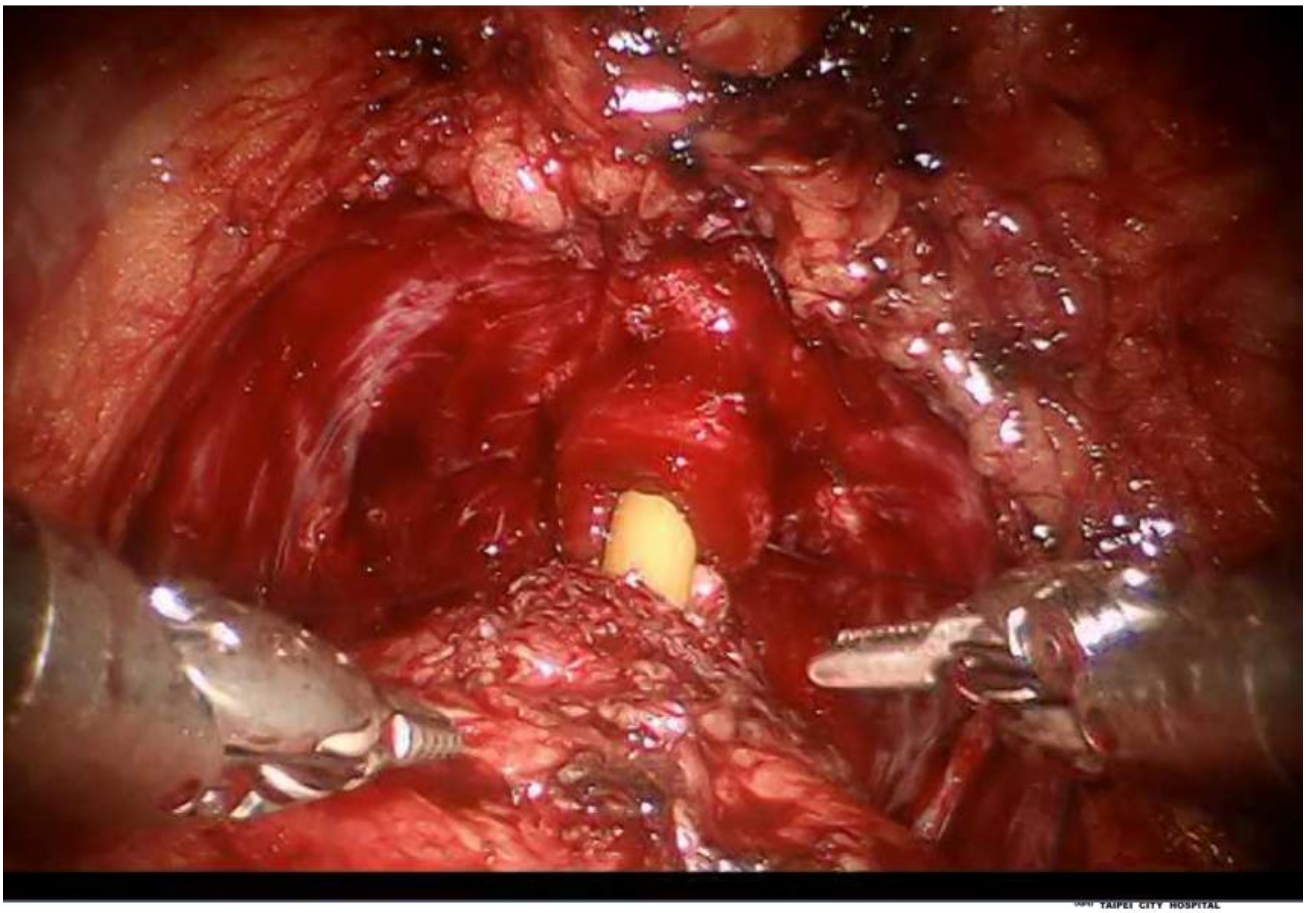



打開膀胱頸


Dissect
Neurovescular bundle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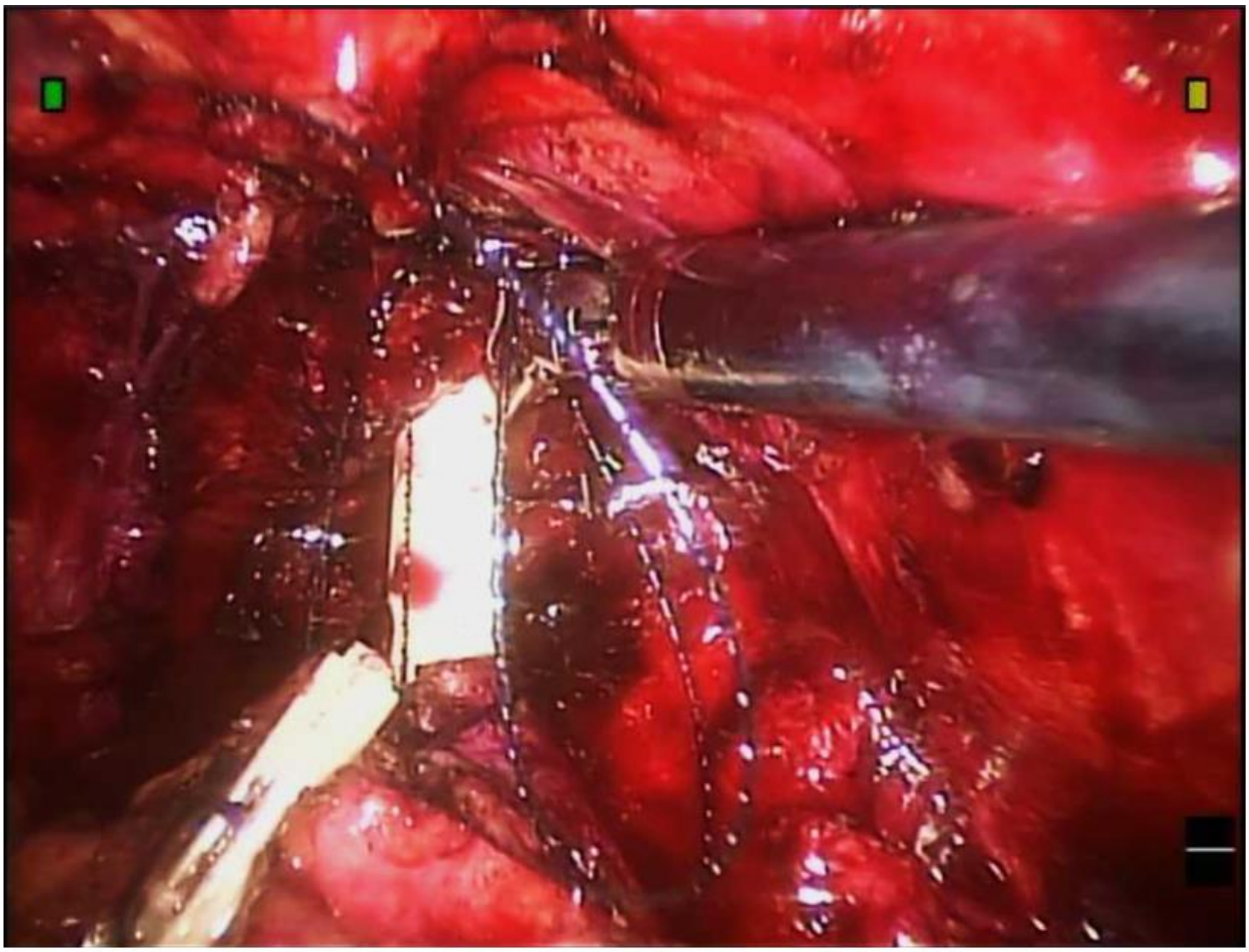

From 2022 to July 2023
38 consecutive patients with localized prostate adenocarcinoma of the prostate were included.

All patients underwent RALP by the Extraperitoneal approach.

Patient profile Parameters

Mean age (years)		65 ± 2.8
Mean prostate size (gm)		37 ± 5 g
Mean PSA (ng/mL)		7.3 ± 2.5
Clinical stage	T1c	11
	T2	24
	T3	3
Biopsy Gleason score		7
Past surgical history	TURP	2
	Laser vaporization	2
	CABG	1
Medical comorbidities	CAD	2
	Diabetes	3

Intraoperative parameters

Mean time for creation of extraperitoneal space (min)	15 ± 4.2
Mean time for docking of robot (min)	12± 7.2
Mean console time (min)	95 ± 4.68
Mean total operative time	147 ± 27
Mean blood loss	210 ± 44
Transfusion	1 (250 cc)

Perioperative parameters

Mean time to drain removal (days)	2 ± 0.55
Mean time to passage of flatus (days)	1 ± 0.85
Mean pain scores (VAS) Day 1 VAS: Visual analogue score	3 ± 1.75
Mean hospital stay (days)	5.3 (Foley indwelling)
Postoperative ileus/ intestinal obstruction	1

Outcomes

Continence (post OP> 6 months)	89%		
Potency	60%		
Pathological stage	pT2 pT3a pT3b	30 7 1	(79%) (18%) (2.6%)
Margin involve	8		(21%)
Biochemical recurrence	0		

Discussion

1. Access time and time for anastomosis did **not differ**
   (21 vs 19 min, $p = 0.11$, and 26 vs 24 min, $p = 0.36$)

2. Surgical time was significantly shorter in **extraperitoneal**
   (225 vs 191 min, $p < 0.001$).

3. Blood loss was equal in both groups
   (EP 276 vs IP 281 ml, $p = 0.88$).

4. Complication rates were lower in EP
   (6.8% vs *n* 8, 12%)

Marcus Horstmann
Single-centre evaluation of the extraperitoneal and transperitoneal approach in robotic-assisted radical prostatectomy. Scandinavian Journal of Urology and Nephrology, *April 2012, Vol. 46, No. 2 , Pages 117-123*

Table 2 Intraoperative, postoperative data, and complications after extraperitoneal RALRP

Perioperative data	
Operative time (min)	
Mean	116.8
Blood loss (ml)	
Mean	482.8
Bladder catheterization (days)	
Mean	8.0
Hospital stay (days)	
Mean	3.9
Transfusion rate (%)	2.8
Lymph node excision (%)	46.1
Nerve-sparing procedure (%)	
No	22.1
Unilateral	9.7
Bilateral	68.1
Complications	
Clavien	
0	94.9
1	0.7
2	4.2
3	0.0
4	0.3
5	0
Anastomosis leakage (%)	1.5
Anastomosis stenosis (%)	0.5

Guillaume
Extraperitoneal robot-assisted laparoscopic radical prostatectomy: a single-center experience beyond the learning curve. World J Urol (2013) 31:447–453

Conclusion

Extraperitoneal approach RARP

1. Shorter operative time.
2. Return to diet earlier.
3. Avoids potential bowel injury
4. Prevents morbidity from urinary extravasation
5. Prevents paralytic ileus.
6. Avoids future bowel adhesion
7. Future laparoscopic surgery is feasible