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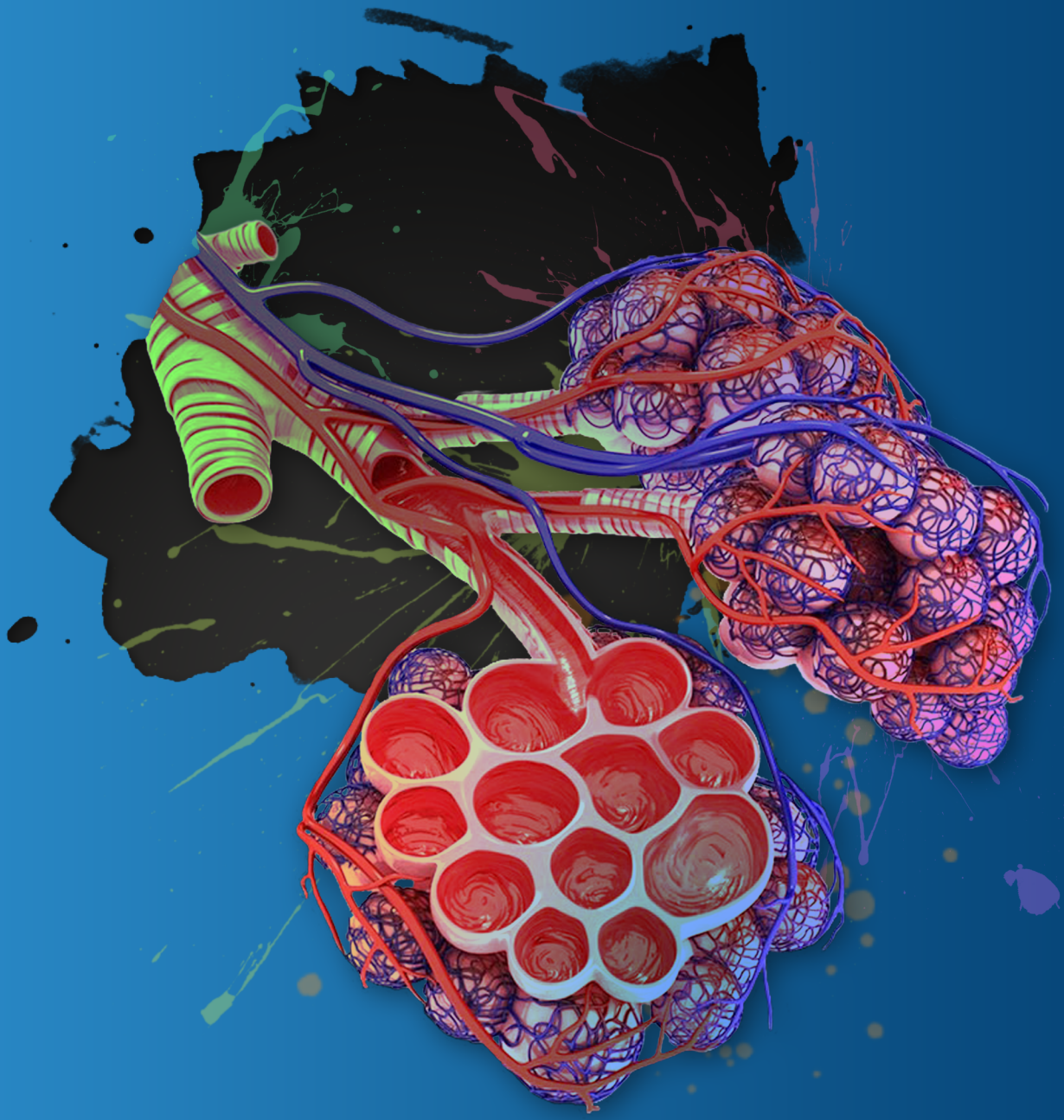

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Editorial Team

EDITORIAL

On behalf of the editorial board of The Interventionalist Journal (TIJ), I would like to extend my deepest appreciation to the founder team, who had built the foundation of this journal.

The aim of The Interventionalist Journal is to provide and served as a platform for all clinicians who are doing minimally invasive procedures to share their findings, expertise, innovations and experiences at the regional and international significance. We envisaged being providing a high-standard and evidence-based platform for publishing high impact publications.

I am humbly inviting each of you to actively participate and contribute to The Interventionalist Journalas an author, reviewer, and reader.The Interventionalist Journal has a strong starting point and I am confident that, we can eventually venture into new heights.

Sincerely,
Ezamin Abdul Rahim
MD, MMed Rad
Editor-in-Chief
The Interventionalist Journal

THE INTERVENTIONALIST JOURNAL

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TRANSBRONCHIAL LUNG CRYOBIOPSY FOR DIFFUSE AND LOCALIZED PERIPHERAL PULMONARY LESIONS: A RETROSPECTIVE REVIEW OF OUR EARLY EXPERIENCE

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ABSTRACT:
Background: Transbronchial lung cryobiopsy (TBLC) is an emerging technique for obtaining lung biopsy. This retrospective study aimed to evaluate the performance and safety of TBLC performed on diffuse peripheral pulmonary lesions (DPPL) and localized peripheral pulmonary lesions (LPPL).
Methods: 58 patients underwent TBLC. They were divided into two groups (DPPL and LPPL) based on radiological findings. The patients' demographic data, procedural details, complications, and radiological and pathologic diagnostic results were analyzed.
Results: The overall diagnostic yield for TBLC was 72.4%. In the subgroup analysis, the diagnostic yield was 74.3% for DPPL and 69.6% for LPPL. For LPPL, the overall diagnostic yield was 87.5% and 12.5% for lesions with positive and negative bronchus signs, respectively (P = 0.01). In both groups, the success of TBLC was not influenced by the size, number, or location of the biopsy. Thirty-two (82%) patients had mild bleeding, while six (15.4%) had moderate bleeding. Pneumothorax occurred in four (6.9%) patients, with three patients requiring chest tube drainage. The mean duration of hospital stay was longer for patients who either bled or developed pneumothorax compared to those who did not (5.64 days vs. 3.47 days; P = 0.014) and (14.25 days vs. 4.24 days; P = 0.035) respectively.
Conclusion: TBLC provided an acceptable diagnostic yield for DPPL and LPPL under fluoroscopy guidance without the use of ancillary devices such as radial endobronchial ultrasound or guide sheath. The safety profile of TBLC corresponded with a low incidence of pneumothorax and manageable bleeding complications with the routine use of an endobronchial balloon.

Keywords: Lung Cryobiopsy, Interventional Pulmonology, Peripheral Pulmonary Lesion, Lung Cancer, Interstitial Lung Disease.

BACKGROUND

The diagnosis of DPPL depends on the patient's clinical history corresponding with consistent radiological findings. However, some cases require tissue sampling for histological confirmation [1]. For DPPL, such as those found in idiopathic interstitial pneumonia (IIP), surgical lung biopsy (SLB) provides a high diagnostic yield compared to conventional transbronchial lung forceps biopsy (TBFB) [2, 3]. However, SLB is associated with a significant mortality rate of 1.7%–21.7% [4]. Although TBFB is considered a safe option, small biopsy specimens (1–2 mm) generally limit its use.

TBLC is an emerging technique for obtaining biopsies with good size and lung architecture preservation from the peripheral lung parenchyma. TBLC has been shown to be capable of improving diagnostic yields compared to TBFB. The retrieval through TBLC of a more significant portion of alveolar tissue with fewer tissue crush artifacts facilitates histopathological interpretation and further immunohistochemistry and oncogenic driver mutation analyses of malignancies [5–7]. TBLC is a less invasive procedure than SLB. However, TBLC comes with a substantial risk of bleeding and pneumothorax, which should be emphasized [7, 9, 10]. To date, TBLC has been widely explored for DPPL and, to a lesser extent, for LPPL [11].

METHODS

Study Design

This work reports on a retrospective cohort study of all patients who underwent TBLC at Serdang Interventional Pulmonology Center in Malaysia between January 1, 2016, and December 31, 2020. Electronic medical records and a picture archiving and communication system were used to retrieve all information relevant to the study. Demographic data, procedural details, complications, and radiological and pathologic diagnostic results were analyzed and recorded.

Pre-procedure Evaluation

For pre-procedure planning, patients' medical histories and computerized tomography (CT) thorax images were reviewed in a radiological meeting attended by interventional pulmonologists, a pulmonologist managing interstitial lung diseases, and two thoracic radiologists. The patients' blood and coagulation profiles were checked, and antiplatelet and anti-coagulant agents were withheld according to guidelines [12].

Radiological Evaluation

High-resolution CT thorax images of all patients (1-mm-thin sections) were reviewed independently by two thoracic radiologists with three years of experience each prior to them reaching a final consensus. For DPPL, the radiological patterns distinguished were categorized IIP according to published guidelines [13, 14]. Other radiological patterns (e.g., diffuse distributions) were subsequently categorized under non-interstitial idiopathic pneumonias (NIIP) based on glossary terms for thoracic imaging provided by the Fleischner Society [15]. Similarly, LPPL were categorized as either masses or consolidations as defined by the Fleischner Society [15].

Application of Anesthesia and Intubation

Xylocaine 10% was used as a topical anesthetic agent before intubation. All patients were provided with total intravenous anesthesia. Target-controlled infusion of propofol and remifentanil was used for the induction and maintenance of sedation. The patients were ventilated using a rigid bronchoscope (Efer-Dumon, France).

Bronchoscopy and Use of a Cryoprobe

Before TBLC, all patients underwent routine bronchoscopic airway assessments. A rigid tracheoscope with a fiberoptic flexible bronchoscope was used (Olympus BF-1T240, Tokyo, Japan). We used a flexible cryo-recanalization probe 1.9 m in length and 2.4 mm in diameter. The cryoprobe (Erbe Elektromedizin GmbH, Tübingen, Germany) used nitrous oxide to induce a temperature of −89.5°C at its tip. A rigid bronchoscope was positioned in the airway for ventilation and allowed rapid reentry of the flexible cryoprobe and flexible bronchoscope. An endobronchial balloon (Chartis balloon catheter, Pulmonx, United States) was used for bronchial blockage. The procedure was performed by two consultants with a minimum of five years of experience each in interventional pulmonology.

Biopsy Procedures and Tissue Sampling

The bronchoscope was placed at the segment chosen for biopsy. Through the working channel of the flexible bronchoscope, the cryoprobe was advanced and passed into the identified distal airways according to pre-procedure planning. The location of the probe was also confirmed through fluoroscopic guidance. For DPPL, the cryoprobe was withdrawn distally (1–2 cm) from the maximal point of resistance. For LPPL, the TBLC was targeted at the localized lesion after careful evaluation of the multiplanar CT. We employed tracing techniques using the bronchus sign and bronchial branch reading, as described previously [16, 17, 18]. Under fluoroscopy guidance, a 4 s freeze time was applied during the patient's exhalation phase. The cryoprobe and bronchoscope were removed en bloc from the airway, and the bronchoscope was kept rigid. After withdrawal of the cryoprobe and bronchoscope, an endobronchial blocker was prophylactically inflated into the biopsied segment with 3 mL of air. A minimum of two biopsy specimens were obtained from each patient. The frozen specimens were thawed in sterile 0.9% sodium chloride saline before being fixed in formalin.

Evaluation and Control of Complications

After 60 s of endobronchial balloon inflation, the balloon was deflated to observe any ongoing bleeding. The severity of endobronchial bleeding was determined based on the recommendations of the British Thoracic Society [19]. For cases with bleeding, the instillation of cold saline (+4°C), diluted adrenalin (1 mg in 10 mL saline; 1 in 10,000), or argon plasma coagulator was one interventional option used before the balloon was reinflated for another 60 s. A chest radiograph was performed for all patients 2 h post-procedure for the evaluation of pneumothorax.

Histological Evaluation

The specimens were fixed in 10% buffered formalin solution and were carefully evaluated by a pathologist with more than five years of experience. The variables specified by the literature as important for evaluating the performance and safety of TBLC, such as the number of specimens, the corresponding biopsy site, and each specimen's size, were inspected carefully and recorded prior to full evaluation.

The biopsy results were identified as indicating either interstitial lung disease or malignancy based on histological diagnoses: 1 = interstitial lung disease: (a) usual interstitial pneumonia, (b) nonspecific interstitial pneumonia, (c) organizing pneumonia, (d) hypersensitive pneumonitis, (e) granulomatous lung disease, (f) pneumoconiosis, and (g) eosinophilic pneumonia; 2 = malignancy: (a) lung adenocarcinoma, (b) small cell lung carcinoma, (c) carcinoid tumor, (d) lung squamous cell carcinoma, and (e) metastatic disease; and 3 = inconclusive.

Diagnostic Yield and Final Multidisciplinary Discussion

The final diagnoses were established through a final multidisciplinary discussion involving a pulmonologist, rheumatologist, radiologist, and pathologist. The TBLC was considered diagnostic when the biopsy specimens demonstrated consistency in histology patterns and radiological findings.

Statistical Analysis

IBM SPSS Statistics for MAC (version 23.0, IBM Corp., Armonk, NY) was used for all statistical analyses. The mean (standard deviation) and median (interquartile range) were used for the results of normally distributed grouped data and non-normally distributed data, respectively. The categorical variables were reported as the frequencies (n) and percentages (%) of the total number of subjects. Baseline data were compared using an independent samples t-test for variables with an assumed normal distribution and the Mann–Whitney U test for non-normally distributed variables. The categorical variables between the two groups were compared using Pearson's chi-square test or Fisher's exact test. The significance level of the analyses was set to 5% ($P < 0.05$).

RESULTS

Fifty-eight patients were included in this study. The patients were divided into two groups based on their radiological patterns (DPPL or LPPL). Their demographic information and other characteristics are presented in Table 1.

The patients' overall mean age was 54 years (SD, 14 years). In both groups, the patients were predominantly non-smokers and ex-smokers. Only three patients were active smokers: one (2.9%) in the DPPL group and two (8.7%) in the LPPL group. A small fraction of the patients in both groups were on antiplatelet medications, with eight (22.9%) and four (17.4%) patients in the DPPL and LPPL groups, respectively. The patients' blood coagulation profiles and platelet counts were similar. The radiological (CT) findings for the DPPL and LPPL groups are presented in Tables 2 and 3, respectively. The most frequent CT pattern for the DPPL group was a nodular pattern (n = 15, 42.9%). Most of the LPPL were categorized as masses (n = 18, 78.3%), with a mean size of 5.31 cm (SD, 2.4 cm).

The overall mean diameters of the biopsy samples obtained for DPPL and LPPL were 6.74 mm (SD, 2.7) versus 9.65 mm (SD, 6.4), respectively. Most of the biopsies were taken from a single lobe. Of the 62 biopsies taken, 41 (66.1%) and 21 (33.9%) originated from the right and left lungs, respectively. Four patients had biopsy samples taken from two lobes because they bled from the first biopsied lobe. The median number of samples per procedure was three (range, 1–6). The overall diagnostic yield of TBLC was 72.4% (42 of 58 patients), which correlated with the clinical, radiological, and histopathologic findings. In the subgroup analysis, the diagnostic yields were 71.4% (25 of 35 patients) for DPPL and 73.9% (17 of 23 patients) for LPPL. For DPPL, the diagnostic yield of TBLC for IIP cases was 75% (6 out of 8 cases), compared to 70.4% (19 out of 27) for NIIP cases. The histology diagnoses for both groups of patients are presented in Table 4. The histology results based on the radiological patterns of NIIP are shown in Table 5.

Six of the ten patients with granulomatous biopsies were diagnosed with pulmonary sarcoidosis after further testing that excluded an underlying infective cause. In the LPPL group, the overall diagnostic yields were 87.5% and 12.5% for positive and negative bronchus signs, respectively ($P = 0.01$). The diagnostic yields based on tissue size were 71.4% (10 out of 14 [size < 10 mm]) and 75% (3 out of 4 [size 10–20 mm and > 20 mm]). The presence of bronchus signs also demonstrated statistical significance (92.9% vs. 7.1%) in the diagnostic yields for the biopsies of mass lesions ($P = 0.02$) (Table 3 and Figure 1). The outcomes for cases with inconclusive transbronchial lung cryobiopsies are shown in Table 6.

Out of 10 DPPL (one ground-glass and two nodular pattern) cases, three had spontaneous resolutions in subsequent radiological surveillance. Three out of six LPPL cases that were inconclusive on TBLC were found to be malignant using subsequent CT scan-guided biopsies (two cases of lung adenocarcinoma and one case of squamous cell lung carcinoma).

Further analyses of both groups were unsuccessful in demonstrating the influence of the number, size, and location of biopsies on the outcome of the TBLC (Table 7).

Table 1: Characteristics of patients underwent transbronchial lung cryobiopsy (n=58).

Variable		DPPL (n = 35)	LPPL (n = 23)	P-value
Sex [n (%)]	Male	16 (45.7)	18 (78.3)	0.016
	Female	19 (54.3)	5 (21.7)	
Age, years [mean (SD)]		53.11 (13.9)	55.82 (14.5)	0.96
Smoking status [n (%)]	Non-smoker	30 (85.7)	11 (47.8)	0.008
	Ex-smoker	4 (11.4)	10 (43.5)	
	Current smoker	1 (2.9)	2 (8.7)	
Medication [n (%)]	Aspirin	6 (17.1)	3 (13)	0.881
	Clopidogrel	2 (5.7)	1 (4.3)	
	None	27 (77.1%	19 (82.6)	
Coagulation profile [mean (SD)]	INR	1.10 (0.2)	2.57 (7.4)	0.68
	Prothrombin time	13.80 (1.2)	13.48 (1.01)	0.55
	Activated partial thromboplastin time	37.46 (5.7)	39.01 (4.9)	0.54
	Platelet count	292.65 (85.4)	298.82 (86.1)	0.99
Biopsy size (mm) [mean (SD)]		6.74 (2.7)	9.65 (6.4)	0.08
Biopsy size (mm) [n (%)]	<10	27 (77.1)	15 (65.2)	0.88
	20-Oct	8 (22.9)	4 (17.4)	
	>20	0 (0)	4 (17.4)	
Locations of transbronchial lung cryobiopsies (n=62)				
Site [n (%)]	RUL	9 (23.1)	6 (26.1)	0.52
	RML	1 (2.6)	3 (13.0)	
	LUL	8 (20.5)	7 (30.4)	
	Lingula	3 (7.7)	1 (4.3)	
	RLL	8 (20.5)	3 (13.1)	0.25
	LLL	10 (25.6)	3 (13.1a)	

RUL: right upper lobe; RML: Right middle lobe; LUL: Left upper lobe; RLL: Right lower lobe; LLL: Left lower lobe.

Safety Analysis

The safety outcome of TBLC for DPPL and LPPL is presented in Table 8. Bleeding complications were observed in 39 cases (67.2%); 32 (82%) patients bled mildly, and six (15.4%) bled moderately. One (2.6%) patient suffered severe bleeding, required a blood transfusion, and had a prolonged stay in the intensive care unit (five days) post-procedure. The mean duration of hospital stay was longer for patients who bled than those who did not (5.64 days vs. 3.47 days; P = 0.014).

Overall, pneumothorax occurred in four (6.9%) patients, with three patients requiring drainage. Patients with pneumothorax had longer hospital stays than other patients (14.25 days vs. 4.24 days, P = 0.035). Two patients also subsequently developed pneumonia and persistent air leaks requiring 17- and 9-day intercostal chest drainage, respectively. No mortality was associated with the

procedure. Overall, there was no association between the number, size, or location of biopsies and the risk of bleeding or pneumothorax (Table 9 and 10).

Table 2: Radiological pattern of DPPL.

DPPL (n = 35)		n (%)
Radiological pattern	**Idiopathic interstitial pneumonias**	
	UIP	2 (5.7)
	NSIP	3 (8.6)
	OP	1 (2.8)
	Non idiopathic interstitial pneumonias	
	HP	5 (14.3)
	Ground-glass opacities	5 (14.3)
	Nodular pattern	15 (42.9)
	Reticular nodular pattern	4 (11.4)

UIP: usual interstitial pneumonia; NSIP: non-specific interstitial pneumonia; OP: organizing pneumonia; HP: hypersensitivity pneumonitis

Table 3: Radiological pattern of LPPL.

LPPL (n = 23)		n (%)	Bronchus sign present	Bronchus sign absent	P-value
Radiological pattern	Mass	18 (78.3)			
	Consolidation	5 (21.7)			
Positive diagnostic yield	Overall	16 (69.6)	14 (87.5)	2 (12.5)	0.01
	Mass	14 (77.8)	13 (92.9)	1 (7.1)	0.02
	Consolidation	2 (40.0)	1 (50.0)	1 (50.0)	1

DISCUSSION

Obtaining good tissue samples for histopathological diagnosis has presented a challenge with many respiratory diseases. The size of a tissue sample is crucial for histopathological interpretation. Thus, interest in exploring a safer biopsy modality that can secure larger biopsy samples without crush artifacts has emerged. Cryobiopsy (CB) is a new lung biopsy method based on the principle of cryotechnology [8]. TBLC provides a larger specimen size, more viable and alveolated tissue, and fewer crush artifacts [6, 7]. Numerous studies have been conducted on the use of CB, especially for interstitial lung disease. However, studies on the use of CB in LPPL remain limited [11, 20]. Conventional techniques, such as transbronchial or CT scan-guided biopsy, remain the standard approach, especially for LPPL.

In the past, the diagnostic yield of TBLC varied among studies because different devices or techniques were used. A recent large, comprehensive meta-analysis of 27 studies comprising 1,443 patients reported an overall diagnostic yield of 72.9% [21]. This meta-analysis was performed on studies involving TBLC in ILD patients. In another recent study, a meta-analysis of nine TBLC studies on LPPL reported a diagnostic yield of 77%, with eight studies conducted using radial endobronchial ultrasound (rEBUS) +/− guided sheath (GS) or fluoroscopy for the localization of lesions [22].

The current study used a 2.4-mm cryoprobe fixed at 4 s of freeze time. The sizes of our biopsies and overall diagnostic yields for both groups (DPPL

Table 4: Histological results of transbronchial lung cryobiopsy for cases of DPPL versus LPPL.

Overall diagnostic yield	DPPL (n = 35) Frequency (%) 25 (71.4)		LPPL (n = 23) Frequency (%) 17 (73.9)
Histopathological examination	IIP (n=8)	NIIP (n=27)	
UIP	3	0	0
NSIP	2	0	0
OP	1	0	0
HP	0	3	0
Pneumoconiosis	0	1	0
Eosinophilic pneumonia	0	1	0
Granulomatous	0	8	2
Adenocarcinoma	0	6	9
Squamous cell carcinoma	0	0	2
Small cell carcinoma	0	0	1
Carcinoid tumor	0	0	3
Inconclusive	2	8	6

Table 5: Histological results base on radiological pattern of NIIP.

	NIIP (n = 27)		
	Ground-glass opacities (n = 3)	Nodular pattern (n = 18)	Reticular nodular pattern (n = 6)
Adenocarcinoma	0	6	0
Granuloma	2	2	4
Eosinophilic pneumonia	0	1	0
Pneumoconiosis	0	1	0
HP	0	2	1
Inconclusive	1	6	1

and LPPL) did not differ much compared to previous studies, which applied a freezing time of 3–5 s. For DPPL, this study demonstrated that the use of TBLC was able to provide reasonable diagnostic yields for IIP and NIIP cases. TBLC is also helpful in obtaining adequate tissue specimens in cases of locally advanced lung malignancy. All six cases diagnosed with lung adenocarcinoma had multiple nodularity patterns (contralateral lobe involvement in four cases and involvement of two lobes on the same side in the remaining two). Three cases in the DPPL cohort (one with ground-glass opacities and two with nodular patterns) that witnessed radiological resolutions on repeated imaging were likely of infective origin. The remaining cases with inconclusive diagnoses from TBLC were either not feasible for CT-guided transthoracic biopsy or the patients opted for surveillance over surgical biopsy. They remained stable on subsequent imaging.

TBLC was preferred over CT-guided transthoracic biopsy (even for LPPL with a mean size of 5.31 cm [SD, 2.4 cm]) after the increased risk of

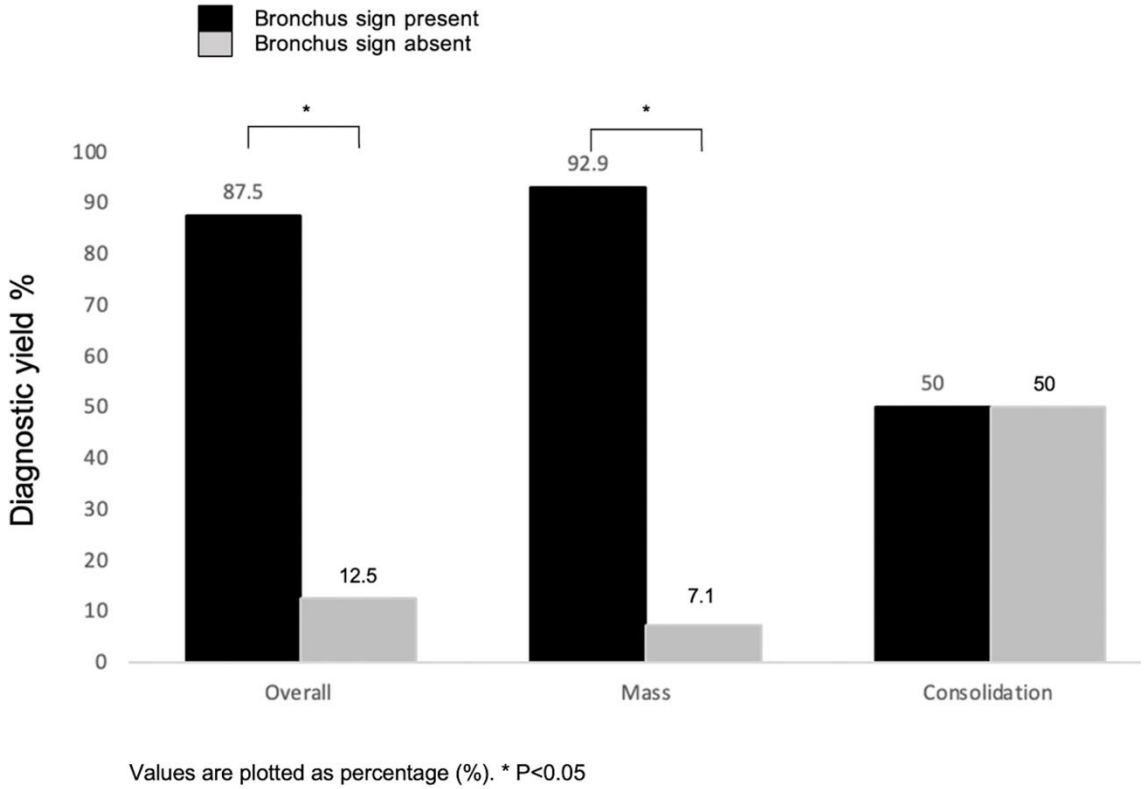

Figure 1: Diagnostic yield of LPPL from TBLC

Table 6: Outcome for inconclusive TBLC.

	DPPL (n = 10)	LPPL (n = 6)
Lesion resolved on repeated imaging	3	
Lesion remained similar on surveillance imaging	7	
Malignancy		3
Infection (Tuberculosis)		2
Organizing pneumonia		1

pneumathorax associated with emphysematous lung changes and the long waiting time for CT-guided transthoracic biopsy were considered. Slightly more than a quarter of LPPL (6 out of 23) had false negative results on TBLC, but the diagnoses were clinched using CT-guided transthoracic biopsy. The factors that could have contributed to a lower diagnostic yield in the LPPL group included the biopsy sites' precision and reduced precision in the placements of the cryoprobe (without rEBUS or GS). A comparison of the groups showed that LPPL lesions were generally more proximal. Thus, the cryoadhesive effects of probes can also be reduced in areas with cartilage and greater collagen content, which may affect biopsy results. A higher diagnostic yield was seen in cases with bronchus signs, consistent with the results published in the past [16, 23, 24]. We found that identifying and navigating the sites of the lesions using an approach combining the bronchial branch reading technique [17, 18] and fluoroscopy were effective in providing reasonable diagnostic yields in the absence of rEBUS, with or without GS. Safety is one of the two most critical concerns when using CB.

Table 7: Univariable logistic regression in predicting the successful diagnosis of DPPL versus LPPL.

Variable		DPPL OR (95% CI)	LPPL OR (95% CI)	P-value
Size of biopsies (mm)	<10	1	1	0.97
	10–20	0.844 (0.219 - 3.255)	INFINITE	
	>20	INFINITE	INFINITE	
Number of biopsies	≤ 3	1	1	0.382
	> 3	0.597 (0.188–1.898)	1.674 (0.527–5.319)	
Location	Lingula	1	1	0.882
	LLL	INFINITE	INFINITE	
	LUL	INFINITE	INFINITE	
	RLL	INFINITE	INFINITE	
	RML	INFINITE	INFINITE	
	RUL	INFINITE	INFINITE	

Table 8: Safety outcome of TBLC performed for DPPL versus LPPL.

Complication		DPPL (n = 35)	LPPL (n = 23)	P-value
Pneumothorax		1 (2.9%)	3 (13.0%)	0.29
No pneumothorax		34 (97.1%)	20 (87%)	
Pneumothorax requiring drainage		1 (2.9%)	2 (8.7%)	
Bleeding	No	10 (28.6%)	9 (39.1%)	0.361
	Mild	22 (62.9%)	10 (43.5%)	
	Moderate	3 (8.6%)	3 (13.0%)	
	Severe	0 (0%)	1 (4.3%)	
Other complications	Prolonged ventilation	2 (5.7%)	1 (4.3%)	1
	No prolonged ventilation	33 (94.3%)	22 (95.7%)	

Bleeding and the occurrence of pneumothorax are the two most important potential complications. A comparative analysis of the complications of TBLC performed for DPPL and PPL is lacking due to the limited number of studies on TBLC performed for LPPL.

For DPPL, the pooled incidence of moderate and severe bleeding reported in a large meta-analysis was 14.2% [21]. A recent prospective single-arm study concluded that TBLC conducted without a bronchial blocker is still a relatively safe procedure for obtaining histology samples for both peripheral and central lung cancer lesions, with only one patient exhibiting severe bleeding [25]. The higher percentage of moderate bleeding observed in our cohort (especially in the LPPL cohort) could be attributed to the lower threshold for the instillation of local adrenaline and cold

Table 9: Univariable logistic regression in predicting bleeding from TBLC.

Variable		OR (95% CI)	P-value
CT interstitial pattern		1	0.402
CT non-interstitial pattern		1.607 (0.528–4.892)	
Size of biopsy (mm)	<10	1	0.795
	10-20	1.371 (0.132-14.226)	
	>20	0.229 (0.019 - 2.708)	
Number of biopsies	≤ 3	1	0.466
	> 3	1.568 (0.466–5.273)	
Location	0 (all other lobes)	1	0.159
	1 (upper lobe)	0.450 (0.147–1.379)	

Table 10: Univariable logistic regression in predicting pneumothorax from TBLC

(B) Pneumothorax

Variable		OR (95% CI)	P-value
CT interstitial pattern		1	1
CT non-interstitial pattern		2.063 (0.201–21.142)	
Size of biopsy (mm)	<10	1	0.126
	10-20	2.036 (0.197–21.069)	
	>20	INFINITE	
Number of biopsies	< 3	1	0.38
	> 3	1.674 (0.527–5.319)	
Location	0 (all other lobes)	1	0.785
	1 (upper lobe)	0.768 (0.263–2.245)	

saline and the use of a larger CB probe (2.4 mm). Biopsy of LPPL also potentially increases the risk of bleeding due to its proximity to the pulmonary vasculature. In addition, the estimation of the degree of bleeding can be subjective, or dependent on the operator, as the degree of bleeding varies with various severity scales [12].

Evidence of the bleeding risk associated with biopsy size is not well established due to heterogeneity in the designs of clinical studies. In accordance with previous reports and analyses [26, 27], we observed that the risk of bleeding increased with the size of the biopsy (comparing samples < 10 mm vs. 10–20 mm), but it remained non-statistically significant in univariable logistic regression. Moreover, this study could not establish any relationship between other previously debated potential factors associated with bleeding, such as the number of biopsies and the location of the biopsy (i.e., the lobe in which it

took place). Therefore, the results of this study reinforce the contention that the bleeding risk is similar regardless of the biopsy being performed at different sites or lobes28, at single or different sites of a single lobe or different lobes, or with the prophylactic application of a balloon [29, 30].

In terms of pneumothorax, the overall rate of 6.8% was acceptable (5.1% required chest drainage). For DPPL, an increased risk of pneumothorax was previously reported with the use of a larger CB probe (2.4 mm) or when TBLC was performed in a different segment in the same lobe or different lobes [22, 29, 30]. The lower incidence of pneumothorax seen in our cohort was primarily due to TBLC being performed at a single site and in a single lobe aided by fluoroscopy (except for four cases in which biopsy was performed in different lobes due to bleeding). Given the lack of robust data in the literature on the occurrence of pneumothorax in LPPL patients, drawing any plausible conclusions would be premature. Overall, we were not able to demonstrate any significant differences in procedural complications between the DPLD and LPPL groups.

The current study has several limitations. The sample size was small and came from a single center. We acknowledge that retrospective studies have the potential for selection bias. Furthermore, prior to 2020, a standardized technique for TBLC sampling (number and location of biopsies) was also lacking [12].

CONCLUSION

TBLC enables optimal lung tissue sampling to facilitate a favorable histological tissue diagnosis for DPPL and LPPL. Similar to DPPL, TBLC provides an acceptable diagnostic yield for LPPL using concomitant fluoroscopy without rEBUS or GS. Pre-procedure planning with ancillary techniques, such as bronchial branch reading, also seems useful. TBLC is associated with a low incidence of pneumothorax, and bleeding complications can be managed with the routine use of an endobronchial balloon. Additional research is needed to provide further insights into patient selection, complication rates associated with different devices and biopsy techniques, and the standardization of the TBLC technique when used for the biopsy of LPPL.

STATEMENT OF ETHICS

Ethical approval for this retrospective study was granted by the National Medical Research Register of Malaysia (NMRR ID: NMRR-20-3170-57192).

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

FUNDING

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DATA AVAILABILITY STATEMENTS:

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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RIGHT MIDDLE CEREBRAL ARTERY INTRACRANIAL STENT FOR INTRACRANIAL ATHEROSCLEROTIC DISEASE

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ABSTRACT:
The article briefly discusses the basis of why the intracranial stent was deployed during mechanical thrombectomy.

Keywords: Intracranial atherosclerotic disease, Middle cerebral artery intracranial stent.

NARRATIVE:

A 51years old Malay who had an acute stroke, the NIHSS score was 6. He had multiple transient ischemic attack for the past 6 month. Two months ago, he was hospitalized for similar acute stroke event and was successfully treated with alteplase. The patient was complete recovered. On examination the left upper limb power was 3/5 and the left lower limb power was 2/5. There is also loss of facial palsy and dysphasia. MRI showed right middle cerebral artery occlusion. Mechanical thrombectomy was performed immediately.

The cone-beam CT image showed (Figure 1) showed an intracranial stent (Solitaire AB, ev3 Inc, Plymouth) in the right middle cerebral artery that was deployed during mechanical thrombectomy.

The main aim of this image of interest is to briefly discuss the basis of why the intracranial stent was deployed during mechanical thrombectomy.

He came to our center within the thrombolysis and thrombectomy window for acute stroke treatment. However, the thrombolysis treatment was not given due to his previous stroke (2 months ago). The MRI showed total occlusion of the right middle cerebral artery, acute core infarction at the right corona radiata and MRI showed a significantly large area of hypoperfusion on MRI perfusion images. The only option left for treatment is mechanical thrombectomy.

The patient had total occlusion of the proximal middle cerebral artery as shown in the angiography image (Figure 2A). Mechanical thrombectomy was done using a stent retriever 4 mm × 20 cm (Solitaire AB, ev3 Inc, Plymouth).

Post mechanical thrombectomy showed persistent significant stenosis at the right M1 segment of the

middle cerebral artery (Figure 2B). We decided to deploy a stent because the arterial flow post stenosis is slightly delayed, and the patient has a large hypoperfusion area on MRI. Fortunately, we already using a stent retriever that can be detached. Solitaire AB is a self-expandable stent, that has enough radial support and one of the best things is the stent can be repeatedly delivered and withdrawn before its detachment. This is an advantage because the operator can position the stent into the desired location prior to its detachment. The stent is also safe to be deployed in stenoses in perforator-rich segments such as the M1 segment of MCA [1].

Post-stenting images showed the deployed stent placement in the M1 (Figure 3A) and its effect on the atherosclerotic plaque and arterial flow (Figure 3B and 3C). The recent literature suggested that intracranial stenting in an acute setting after a futile mechanical thrombectomy is effective and should be considered in a patient with a baseline NIHSS score of ≤9 [2].

STATEMENT OF ETHICS:

Informed consent was obtained from the patient for the publication of this work.

CONFLICTS OF INTEREST:

The authors have no potential conflicts of interest to disclose.

FUNDING:

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DATA AVAILABILITY STATEMENTS:

Further information regarding the data used for this work can be obtained from the corresponding author upon reasonable request.

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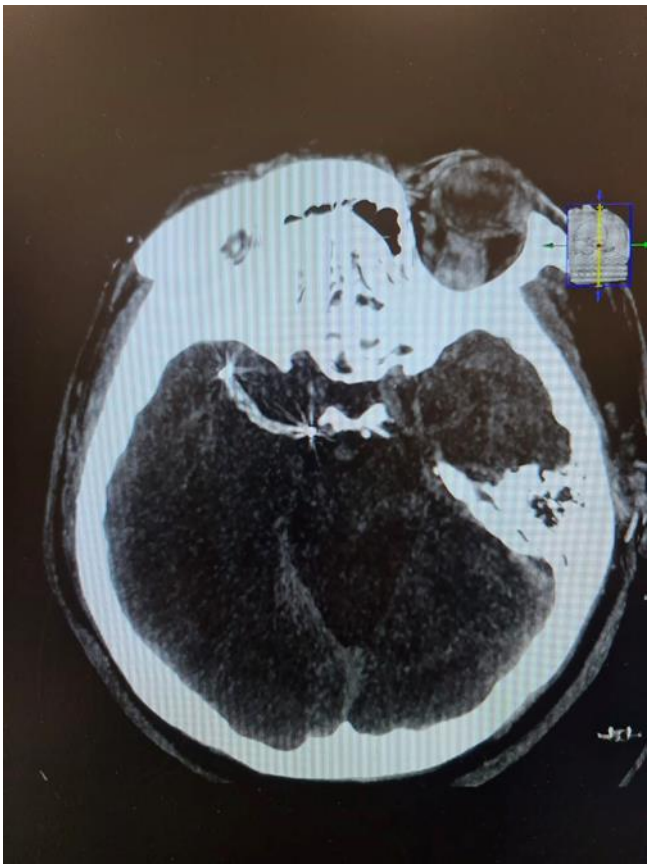

Figure 1: Intracranial stent in the right middle cerebral artery that was deployed during mechanical thrombectomy

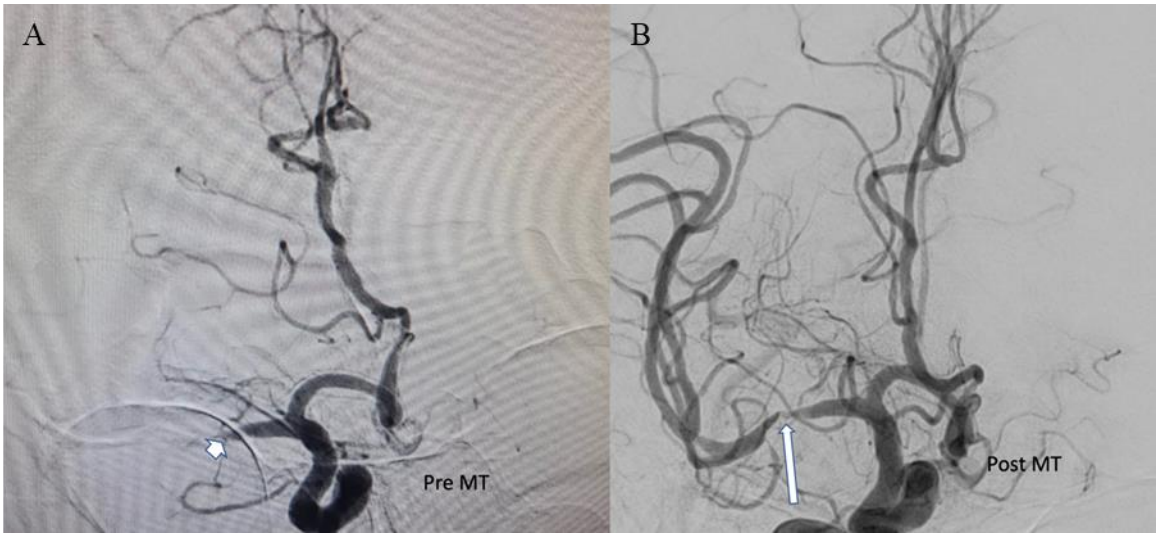

Figure 2: (A) Angiographic image in Anteroposterior view showed total occlusion of the right M1 prior to mechanical thrombectomy (short arrow) and (B) significant stenosis post mechanical thrombectomy (long arrow)

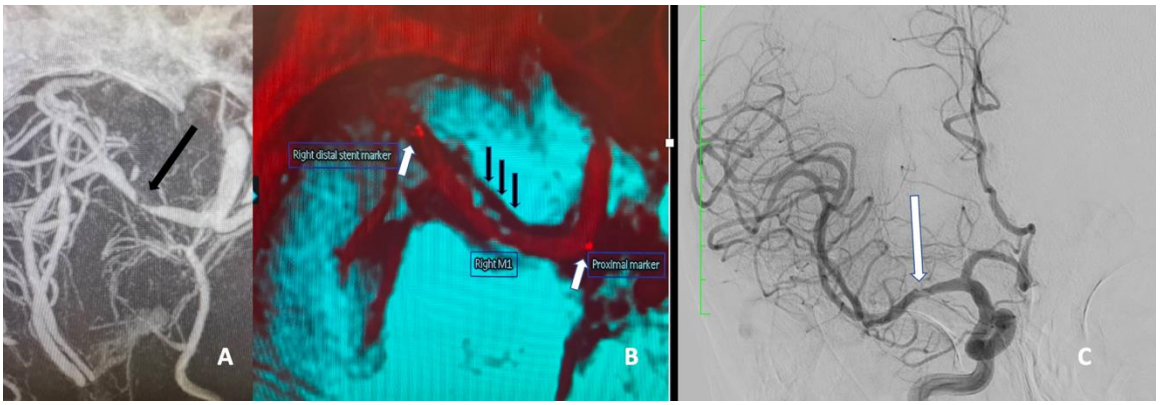

Figure 3: Smart CT Vaso image showed the site of intracranial atherosclerotic disease (long black arrow) (A). Fusion imaging MRI post gadolinium black blood with Intraarterial Smart CT Vaso image. The short white arrow showed the distal marker and proximal marker of Solitaire AB stent. The 3 short black arrows showed the atherosclerotic plaque appearance with stent in situ (B). Post intracranial M1 stenting angiographic image (image C) showed the area of atherosclerotic plaque after intracranial stenting (long white arrow).

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OP01

COMPARING EFFECTS OF C-ARM CONE BEAM CT AND HYBRID-CT/C-ARM SYSTEMS ON PATIENT RADIATION DOSE IN TRANSARTERIAL CHEMOEMBOLISATION PROCEDURES

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Background/Purpose:
C-arm cone-beam computed tomography (CBCT) and hybrid-CT/C-arm are the two main systems used to perform transarterial chemoembolization (TACE). However CBCT poses certain disadvantages compared to hybrid-CT/C-arm such as smaller field-of-view and inconsistent anatomical detail. The study aims to further evaluate the difference in patient radiation dose between usage of CBCT and hybrid-CT/C-arm in TACE procedures.

Materials and Methods:
TACE procedures performed between July 2016 and July 2022 were collected and grouped by imaging modality (3D-guided vs only 2D) and imaging system (C-arm CBCT vs hybrid CT/C-arm). Differences in patient characteristics and patient radiation dose were analysed. Kerma-area product (P_{KA}) and dose-length product (DLP) were converted to effective dose (ED) for comparison. Reference air-kerma ($K_{a,r}$) was also collected.

Results:
A total of 378 procedures was analysed with 348 undergoing 3D-guided procedures and 30 undergoing 2D-guided procedures. Of the 3D-guided procedures, 176 were performed using C-arm CBCT and 172 were performed using hybrid-CT/C-arm. The total ED in the hybrid-CT/C-arm group was 1.5 times lower than in C-arm group (median 37.9 vs 55.3mSv, $p<.001$). Total KAP and $K_{a,r}$ were both lower in the hybrid-CT/C-arm 3D group than the C-arm group (median 123.3 vs 248.3Gycm^2, $p<.001$ and 1030 vs 1153mGy $p=0.043$ respectively). Within the patients undergoing 2D-guided procedures, KAP, ED and $K_{a,r}$ were all significantly higher in patients who performed procedures in hybrid-CT/C-arm IR suites than in those who performed procedures in the C-arm IR suites (median 136.3 vs 53.3Gycm^2, $p=0.030$; 21.8 vs 8.53mSv, $p=0.030$ and 1011 vs 307mGy, $p=0.026$ respectively).

Conclusion:

Usage of C-arm CBCT during TACE procedures significantly increased patient radiation dose as compared to hybrid CT/C-arm. More widespread usage of hybrid-CT/C-arm in the context of TACE procedures is recommended to reduce patient risk of stochastic and deterministic effects.

OP02

RIGHT INFERIOR PHRENIC ARTERY SUPPLY OF HEPATOCELLULAR CARCINOMA (HCC) DURING TRANSARTERIAL CHEMOEMBOLISATION (TACE): EVALUATION OF THE ORIGIN, CLINICAL SIGNIFICANCE, CHARACTERISTIC AND COMPLICATION

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Background/Purpose:
HCC is the most common type of primary liver cancer (80%) and the 6th most common liver cancer worldwide. Transarterial-chemoembolization (TACE) is a minimally-invasive procedure and remains the treatment of choice for intermediate-stage HCC. Extrahepatic blood supply most commonly arises from the Right Inferior Phrenic Artery (RIPA). Knowing RIPA variations will help increase the therapeutic efficacy of TACE leading to successful treatment of HCC.

Materials and Methods:
We present 17 patients with RIPA supply to HCC detected from 2021-01-01 to 2022-08-13 during chemoembolization performed at our center.

Results:
RIPA origin from the right renal artery was noted in 11 patients (64%). Less common origins of RIPA supply were from the right adrenal artery, aorta, coeliac axis, and inferior pancreaticoduodenal artery (IPDA). RIPA which arises from the IPDA branch of Superior Mesenteric Artery. There were 14 patients (82%) with lesions arising from Segment VII/VIII of the liver. Two patients (12%) have RIPA supply to Segment IV lesion (10th and 11th TACE). Segment VI lesion supplied by RIPA was seen in one patient. RIPA supply was detected in patients undergoing their first to 11th TACE session with a median of 5th TACE session. All the lesions were peripherally located and abutting the diaphragm. The size of the lesions ranges from 3.7 cm – 20.0 cm (mean = 7.4 cm). Chemoemulsion of iodized oil (Lipiodol; André Guerbet, France) and chemotherapeutic drugs (Epirubicin and Mitomycin) were used for chemoembolization in 16 of the patients (94%). Lipiodol deposition was seen at the head of the pancreas (1 patient), adrenal (1 patient), and diaphragm (1 patient) on post TACE CT with no significant sequelae. The diaphragmatic injury was seen in one patient for whom DC Beads were used for chemoembolization.

Conclusion:
RIPA supply of HCC was associated with a large, peripherally located tumour in Segment VII/VIII that was abutting the diaphragm. Familiarity with the origin of RIPA is important in treating large right lobe HCC. The right renal artery is the most common RIPA origin in our series.

OP03

TREATMENT OUTCOMES OF SCLEROTHERAPY FOR LOW-FLOW VASCULAR MALFORMATIONS AT SOUTHERN PHILIPPINES MEDICAL CENTER

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Background/Purpose:
Vascular malformations are complex developmental disorders of angiogenesis that present formidable diagnostic and treatment challenges. In the past, surgical resection was the preferred treatment for low-flow vascular malformations. Recently, percutaneous sclerotherapy has shown many advantages over surgery and has emerged as the primary therapeutic approach. The main purpose of this study is to report the treatment outcomes of low-flow vascular malformations at Southern Philippines Medical Center (SPMC), a tertiary government hospital in the Philippines.

Materials and Methods:
This is a retrospective study assessing the treatment outcomes of patients who underwent percutaneous sclerotherapy for low-flow vascular malformations at SPMC over a 5-year period from Jan. 2017 to Jan. 2022. The main objective is to determine which among the sclerosing agents (ethanol, bleomycin or combination) used for low-flow vascular will be the most effective in terms of treatment imaging outcomes and the least procedure-related complications.

Results:
A total of 36 patients between 1 year old and 69 years old were treated (26 venous malformations and 10 lymphatic malformations). Sclerosing agents used were ethanol (15 cases), bleomycin (8 cases) and combination of ethanol / bleomycin (13 cases). After a median follow-up at least 6 months after the last session, 35 cases (97.25%) had effective imaging outcomes defined as more than 50% reduction of the original size and only 1 case (2.8%) of bleomycin treatment was ineffective with reduction of less than 50%. 5 minor complications (13.8%) were observed (4 cases [11.1%] for ethanol and 1 case [2.7%] for combination of bleomycin and ethanol). No major complications were noted.

Conclusion:
Percutaneous sclerotherapy is an effective treatment for low flow vascular malformations with least complications when using bleomycin and combined bleomycin/ethanol as sclerosing agents, compared to ethanol alone.

OP04

EFFECTIVENESS OF AN INSTITUTIONAL ANTIBIOTIC PROPHYLAXIS GUIDELINE IN PATIENTS UNDERGOING RADIOFREQUENCY AND MICROWAVE ABLATION OF LIVER TUMORS: A RETROSPECTIVE COHORT STUDY

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Background/Purpose:
At our institution, patients undergoing liver ablation were receiving antibiotic prophylaxis (AP) heterogeneously. An in-house antibiotic prophylaxis guideline was developed in May 2019 by the antimicrobial stewardship unit and the department of vascular and interventional radiology to standardize AP prescription. This study evaluated the effectiveness and clinical outcomes of the newly launched AP guideline on patients undergoing radiofrequency (RFA) and microwave (MWA) ablation of the liver.

Materials and Methods:
This was a retrospective cohort study of patients who underwent RFA and MWA at Singapore General Hospital before and after the implementation of guidelines from November 2018 to April 2019 and October 2019 to March 2020 respectively. Patients with prior infection or on antibiotics treatment before liver ablation were excluded. Patients without high risk of biliary tree contamination were recommended a single dose of 2g IV cefazolin (or 600mg IV clindamycin in cases of beta-lactam allergy). Any deviation in antibiotic choice or duration without suspected post-procedural infections was considered inappropriate. Univariate analysis was conducted to evaluate the clinical outcomes.

Results:
The study included 87 patients who underwent 93 procedures consisting of 18 RFAs and 75 MWAs for liver tumours. Concordance with AP guidelines improved significantly (38.5% vs. 87.0%; $p<0.001$). Prescription of the recommended single dose 2g IV cefazolin for patients without high-risk factors increased after the guideline was implemented (40.0% vs. 97.8%). There were no ablation-related infections and mortality within 30 days post-ablation, and post-procedural nausea and vomiting were significantly reduced (15.4% vs. 1.9%; $p=0.020$). No significant difference in post-procedural fever (7.7% vs. 5.6%; $p=0.693$), chest and/or abdominal pain (5.1% vs. 7.4%; $p=1.000$) were noted.

Conclusion:
The newly implemented in-house antibiotic prophylaxis guideline streamlined AP prescribing in patients undergoing RFA and MWA. Additional research is needed to determine the effects on infection and mortality in patients with high-risk of biliary tree contamination.

OP05

PERCUTANEOUS MICROWAVE ABLATION OF BENIGN BREAST LESION: A REPORT OF TWO PIONEER CASES IN MALAYSIA

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Case Description:
Fibroadenoma is the commonest type of benign breast lesion (BBL) resulting from proliferation of ductal or lobular tissue which manifests by the presence of palpable lumps. Fibroadenoma is conventionally open excised in our local setting. However, surgical excision is more destructive to breast tissues and hence cosmetic outcome is less desirable .We report two cases of attempted fibroadenoma resolution via ultrasound-guided percutaneous microwave needle ablation without cutting and removing any breast tissue.

Case 1 was a 21-year-old lady who presented with a palpable left breast lump for 6 months at 1 O'clock region 3 cm from nipple measuring 1.1x2.3cm.

Case 2 was a 30-year-old lady who presented with two palpable right breast masses for 12 months duration one at the 7 O'clock region 4cm from nipple measuring 1.0x1.9x1.7cm and the other at the 10 O'clock region 3cm from nipple measuring 0.8x1.2x1.3cm.

Triple assessments were done for both of them and the diagnosis was later confirmed by histopathology examination as fibroadenoma . Patients were counselled and both keen for a treatment which was less invasive and would preserve the cosmetic appearance of the treated breast. Therefore, percutaneous microwave needle ablation was offered as a pioneer means of intervention.

During the procedure a 1.6mm antenna needle was inserted into the targeted breast lump under real time ultrasound imaging guidance, to ablate the tumor. A small waterproof plaster was applied on the needle nick after the procedure. No immediate post procedural complications were observed.

Discussion/Conclusion:
These two cases illustrate a feasible and good patient acceptance of microwave needle ablation as an alternative minimally invasive approach without the need to have an open wound or stitching. It reduces the likelihood of scarring and preserves the cosmetic appearance of the breast. An aesthetically pleasing result was achieved for both patients in a span of 15 mins, respectively. Patients will be continually reviewed via scheduled breast ultrasound for the intervals of 1, 3, 6, 12 and 18 months to monitor for complete ablation.

OP06

ADRENAL VENOUS SAMPLING (AVS) PROCEDURE USING CONE BEAM CT; NATIONAL CANCER INSTITUTE'S EXPERIENCE

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Introduction:
Adrenal Venous Sampling (AVS) is the gold standard test to identify sources of excess aldosterone. It is highly advisable to perform this procedure for a patient with Primary Aldosteronism. It can determine the overproduction of the aldosterone whether it is unilateral or bilateral. The test will provide a decisive treatment plan for the patient. A unilateral secretion can be surgically treated.

Case Report:
AVS procedure has a reputation as a challenging procedure and demands great skills of the Interventional Radiologist (IR). Sampling is performed from each adrenal vein together with peripheral samples using variation of catheter in sequential or simultaneous manner. Anatomically, the right adrenal vein originates directly from the inferior vena cava while the left adrenal vein originates from the left renal vein. Due to the anatomical structure, it is difficult to recognise the adrenal veins for selective cannulations. Technically, the right adrenal vein is more challenging to cannulate than the left adrenal vein. Multiple techniques and strategies are used by the IR to perform AVS procedure. In National Cancer Institute (NCI), Cone Beam CT is used during AVS procedure to aid the selective cannulation of the adrenal veins.

Conclusion:
A conclusion of a successful AVS can be drawn by the level of the cortisol from the derived bloods. Since cortisol is only produced by adrenal glands, it is assumed that there is an increment of cortisol level in the adrenal veins compared with peripheral veins. The result will then be further used to calculate the lateralisation index. We are using this method since the year of 2020, the success rate of AVS sampling is 100%.

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EP01

A RARE CASE OF POST MVA CERVICAL LIGAMENTOUS TEAR COMPLICATED WITH VERTEBRAL ARTERIOVENOUS FISTULA (VAVF) WITH SUCCESSFUL ENDOVASCULAR TREATMENT

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Introduction:
Vertebral arteriovenous fistula (vAVF) post Motor Vehicle Accident (MVA) is a rare condition caused by abnormal communication between the vertebral artery with the adjacent veins. In post MVA setting, it is commonly associated with vertebral body fracture particularly, the foramen transversarium.

Case Report:
We report a case of a 19 year old girl who presented with complete C2/C3 anterior and posterior ligament tear post MVA. CT angiogram (CTA) gave a suspicion of pseudoaneurysm at right posterior C3 vertebral body causing mass effect to spinal cord. MRI showed traumatic AVF at C2/C3 level involving the V2/V3 right vertebral artery to the vertebral venous plexus. Digital Substraction Angiography (DSA) revealed a transected right vertebral artery at C2/C3 level with arteriovenous fistula and enlarged vertebral venous plexus. The fistulous communication was successfully occluded from cranial and caudal approach to the transected segment right vertebral artery with a total of 8 coils.

Conclusion:
In conclusion, post MVA vertebral arteriovenous fistula (vAVF) is a rare sequelae of ligamentous and vertebral bony at the cervical region. Endovascular treatment with ipsilateral vertebral artery closure is a feasible treatment of vAVF.

EP02

SIGNIFICANTLY LESS BLEEDING INTRAOPERATIVELY WITH FAVORABLE POST-SURGICAL OUTCOMES FOLLOWING ENDOVASCULAR COILING AND AMPLATZER VASCULAR PLUG FOR AURICULAR ARTERIO-VENOUS MALFORMATION

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Introduction:
Arterio-venous malformation (AVM) is characterized by an anomalous connection of arterial and veins that bypass the capillary vessels. Although auricular was cited as the second most prevalent location for vascular malformations in the head and neck, the incidence was rather rare. This region and its naturally high-flowing characteristic can be devastating and have a detrimental effect on the quality of life.

Case Report:
A 20-year-old male was admitted to the emergency department for pain and left ear enlargement with a palpable and pulsating mass within his left auricle. Ultrasound and contrast-enhanced Multi-Slice Computed Tomography (MSCT) scans were performed for suspicion of vascular malformation. The patient was diagnosed with AVM Schobinger Stage II-growing progressively. Angiography revealed the feeding artery from the auricular artery, branches of the External Carotid Artery (ECA), and draining vein in the Left Jugular vein which matched the Yakes and Baumgartner type IIIa. Several attempts on Endovascular coiling were utilized in ECA branches but resulted in insignificantly reduce of the flow. A successful blockade of the ECA was yielded by the placement of an Amplatzer Vascular Plug at the distal end of the ECA. Subsequently, multiple reconstructive surgeries were performed, with a total reported blood loss of 50 cc during the initial mass-excision operation, without any complications nor complaints about hearing function, and with a satisfactory result.

Conclusion:
An efficacious endovascular approach as the treatment of Auricular Arterio-Venous Malformation (AVM) using coiling and Amplatzer vascular-plug deployed at the distal end of ECA to occlude the shunt and the abnormal high-flow malformation was described. This procedure resulted in significantly reduced intraoperative bleeding with a favorable outcome.

EP03

POSTERIOR TRANSGLUTEAL CT FLUOROSCOPY GUIDED PERCUTANEOUS DRAINAGE OF DEEP PELVIC ABSCESS IN SULTAN HAJI AHMAD SHAH MEDICAL CENTRE @IIUM (SASMEC @IIUM): A CASE SERIES

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Abstract:
Deep pelvic abscesses in many instances are very challenging to treat surgically. Presence of many structures within the tight pelvic cavity make surgical intervention very difficult and risky. Posterior transgluteal CT fluoroscopy guided percutaneous drainage of these abscesses is much safer and amendable for treatment. Although technically straightforward, good pelvic cavity anatomical knowledge and axial CT image interpretation skill is detrimental to achieve satisfactory results. We review five (5) cases of posterior transgluteal CT fluoroscopy guided percutaneous drainage of deep pelvic abscess performed in our center within these past 2 years with good outcome.

EP04

PERCUTANEOUS TRANSHEPATIC BILIARY DRAINAGE IN ADULT BILIARY ATRESIA WITH NATIVE LIVER: A CASE SERIES

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Abstract:
Patients with biliary atresia (BA) require Kasai portoenterostomy (KP) during infancy to improve biliary flow. Following KP, patients commonly develop biliary complications, such as jaundice, recurrent cholangitis, biliary stricture, and multiple cystic intrahepatic dilatations, which will further lead to biliary cirrhosis and liver failure that requires liver transplantation. Percutaneous transhepatic biliary drainage (PTBD) can be performed to treat biliary complications in post KP biliary atresia patients. However, PTBD is technically challenging due to biliary strictures and intrahepatic bile duct dilatation, and its effectiveness remains controversial. Therefore, we described two cases of successful percutaneous transhepatic biliary intervention with a novel technique after KP in adult KP patients with native liver. Following the procedure, both patients achieved short-term and long-term clinical improvement. We observed that cholangitis resolved, and liver enzymes remained normal. Interval hepatobiliary ultrasound did not show biliary dilatation or liver cirrhosis. Both patients are not on the liver transplantation list. To our knowledge, this is the first successful demonstration of the novel technique in percutaneous biliary intervention in adult BA patient status post KP.

EP05

MAY-THURNER SYNDROME CONUNDRUM: MASSIVE SUBCAPSULAR LIVER HEMATOMA FOLLOWING INTRAVENOUS THROMBOLYSIS FOR DEEP VEIN THROMBOSIS

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Introduction:
May-Thurner Syndrome (MTS) is caused by compression of the left common iliac vein by overlying right common iliac artery against the spine resulting in varicosities, deep venous thrombosis (DVT), chronic venous stasis ulcers or pulmonary embolism. MTS is rare, accounts for only 2% to 5% of all patients presenting with DVT. In our case, the patient had unprovoked long segment left iliofemoral DVT. She developed huge subcapsular liver hematoma, upon receiving thrombolytic drugs which is a rare complication of anticoagulant therapy (incidence of 1%).

Case Report:
A 46-year-old female with no comorbid, presented with left lower limb swelling and pain for two weeks. Ultrasound Doppler demonstrated long segment left lower limb DVT from left popliteal into left external iliac veins. Anticoagulant was initiated and Computed Tomography (CT) scan abdomen was done which confirmed the diagnosis of MTS. Catheter directed left femoral and iliac vein thrombolysis, thrombectomy, stenting and venoplasty was performed. Post procedure, patient developed shortness of breath, severe abdominal pain and drop in haemoglobin (12 to 7 g/dL). CT scan showed huge subcapsular liver hematoma, measuring 15.5cm and 20.0cm in diameter and height respectively. The anticoagulant therapy was ceased and patient was transfused. Ultrasound guided drainage of liver hematoma was done for symptomatic relief.

Conclusion:
MTS can lead to serious consequences in healthy adult; in our case long segment DVT. MTS is not only uncommon to diagnose, but also challenging in treatment. In this case, the anticoagulant therapy caused spontaneous huge subcapsular liver hematoma in turn, requiring further intervention.

EP06

FIRST SUCCESSFUL TRANSCHOLECYSTO-CYSTIC DUCT COMMON BILE DUCT STENTING IN A CASE OF MALIGNANT OBSTRUCTIVE JAUNDICE

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Abstract:
Malignant obstructive jaundice is a disease that leads to multiple pathological conditions that could negatively affect patient outcome. Majority of the time, it can be treated with either Endoscopic Retrograde Cholangiopancreatography (ERCP) and Percutaneous Transhepatic Biliary drainage (PTBD) with success rate up to 100%. In recent years, endoscopic ultrasound guided biliary drainage (EUS-BD) has start to takeover the role of PTBD in cases where ERCP failed. It has shown to be safer with similar success rate. However, it does require the procedure to be done in a highly specialized center where the expertise is available. We here present a case report where CBD stenting is done through passage of cholecystotomy-cystic duct. A-53-year old female presented to our center with features of obstructive jaundice. CT scan revealed uncinate tumor with minimally dilated common bile duct (CBD) and intra-hepatic duct (IHD). Multiple attempts of ERCP and PTBD failed due to difficult cannulation and inadequate dilation of IHD. Furthermore, EUS-BD expertise was not available in our center. A percutaneous cholecystostomy was performed for temporary biliary decompression. After multidisciplinary discussion was made, decision was made for trans-cholecysto-cystic duct CBD stenting. The procedure was a success with no major complications. Multiple modalities of biliary decompression have been developed since early 1970 with ERCP and PTBD as the 2 most common procedure. However, with the development and introduction of EUS-BD, PTBD has fallen out of favor due to high rate of complications. However, EUS-BD is still developing with sparse expertise especially in a developing country. Transcholecysto-cystic duct biliary stenting which our center has done has shown to be simple and effective in biliary decompression even in tortuous cystic duct. More such procedures should be done to know the safety profile and efficacy of such procedure.

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EP07

CASE OF REFRACTORY AND RECURRENT RADIAL ANEURYSMAL BONE CYST TREATED WITH TRANS-ARTERIAL EMBOLISATION AND PERCUTANEOUS SCLEROTHERAPY – OUR EXPERIENCE

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Introduction:
Aneurysmal bone cyst is defined as benign expansile osteolytic locally aggressive bone lesion that typically affects more than 70% of adolescent with common location includes long bone metaphysis. The mainstay of treatment is complete intralesional curretage and excision however in cases of incomplete excision, there has been reported rate of recurrence up to 59%. Our case is to highlight the combined treatment of trans-arterial embolisation and percutaneous sclerotherapy in the case of recurrence and refractory aneurysmal bone cyst.

Case report:
22 y.o. lady previously presented in 2019 with pain and swelling of left wrist and subsequently diagnosed with distal left radius aneurysmal bone cyst. She had undergone curretage of left radius and right iliac bone graft in 2019 with second operation in 2020; whereby extended curretage and reconstruction with autologous bone graft from iliac crest was performed. Despite this, the lesion persistently increased in size with patient complaining persistent weakness and pain. She was then referred to us after opting for sclerotherapy treatment. Pre-treatment MRI was performed demonstrating increment in the size of the lesion with no evidence of sarcomatous change. Percutaneous sclerotherapy was performed using sclerosant foam containing sodium tetradecyl sulphate (STS) at three-monthly interval with improvement in clinical symptoms and follow-up radiograph demonstrating cortical mineralisation. However, the lesion demonstrate further increment in size post fifth sclerotherapy. She was then subjected with combined trans-arterial embolisation and percutaneous sclerotherapy. Pre-embolisation angiogram demonstrates multiple small abnormal feeding vessels arising from the radial artery that subsequently occluded using diluted polyvinyl alcohol (PVA) followed by percutaneous sclerotherapy using STS sclerosant foam. This patient is still currently on our ongoing follow up as well as monitoring of symptoms and radiographic improvement.

Conclusion:
Despite the challenge of treating recurrence and refractory aneurysmal bone cyst, we would like to present combined treatment of trans-arterial embolisation and percutaneous sclerotherapy as a treatment strategy.

EP08

ANGIOEMBOLISATION OF CREMASTERIC ARTERY FOR SCROTAL HAEMATOMA FOLLOWING HERNIAL REPAIR

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Introduction:
Left cremasteric artery is a branch of inferior epigastric artery and courses laterally deep into the fascia transversalis entering the cord deep to the internal spermatic fascia supplying the cremaster muscle and coverings of the cord. This course renders the artery to be prone for injury during procedure such as hernioplasty; one of the possible consequences is scrotal haematoma. We present a case of haemorrhage from unexpected cresmastric artery injury post-hernioplasty treated with angioembolisation. To the best of our knowledge, this has not been reported in literature.

Case Report:
A 66-year-old gentleman with left indirect inguinal hernia underwent a left inguinal hernioplasty in our institution with no immediate complications. However he presented to the emergency department the day after the procedure with complaints of rapidly worsening painful left scrotal swelling accompanied with symptoms of intestinal obstruction. Emergency laparotomy and re-do left hernioplasty was performed, revealing a strangulated inguinoscrotal hernia. Post-operatively, there was non-resolving scrotal swelling with a drop in the haemoglobin level; from 11.9g/dl to 8.5g/dl requiring packed cell transfusion. CT angiogram revealed active contrast extravasation from the left cremasteric artery. Angiographic run confirmed the finding and the left cresmatric artery was superselectively cannulated with a 1.9Fr microcatheter and embolization done with 0.5mm microcoil. Post-embolisation run showed resolution of active haemorrhage with preservation of proximal vessel. Ultrasound scan 24-hour post-procedure reproduced proximal vessel patency. Clinically there was a reduction of the left scrotal swelling and the haemoglobin remained stable.

Conclusion:
Iatrogenic scrotal haematoma may result from injury to the artery supplying the scrotum and/or testis. This artery is usually small in caliber and its identification is important for efficient and effective treatment. Angioembolisation is able to treat this injury with superior precision owing to its ability for localization and selective cannulation of the offending vessel.

EP09

EMBOLIZATION OF A HIGHLY VASCULAR CERVICAL SPINE TUMOUR AND IMAGING ASSESMENT PRIOR TO SURGERY

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Abstract:
Spinal metastases from advanced hepatocellular carcinoma (HCC) often manifested as bone pain, paraesthesia, or neurological deficit which then requires surgical resection of the tumour for better pain management and to avoid permanent neurological deficit. The pre-operative imaging of the tumour, particularly the vasculature needs to be properly assessed to avoid undesirable massive intra-operative bleeding. Embolisation of a highly vascular tumour prior to surgery is highly recommended and it is a known safe technique for better intra-operative haemostasis control. We presented a case report of an elderly male with advanced HCC with cervical spine metastases who presented with limb weakness and numbness. He underwent immediate surgical tumour resection however the surgery was abandoned due to massive blood loss of five thousand millilitres (mL). He was then referred to our interventional radiologists where he underwent total embolisation left vertebral artery, the major feeding artery of the tumour. The subsequent surgical resection was successful with significant reduction of intraoperative blood loss of eight hundred millilitres (mL). Imaging (CT brain) and clinical assessment post embolization showed no evidence of embolization – related complication, i.e., stroke.

EP10

PRE-OPERATIVE EMBOLIZATION OF ANGIOSARCOMA OF THE HEAD: A CASE REPORT

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Introduction:
Angiosarcoma of the head is one of the rarest soft tissue tumors of vascular endothelial origin in the pediatric population. This is a case report of a 1 year old male with angiosarcoma of the head and emphasizes the importance of multidisciplinary approach in its management, particularly pre-operative embolization by the interventional radiologist before surgical excision of the mass.

Case Report:
A 1-year-old male presented with a rapidly enlarging mass arising from the right parietooccipital region of his head since birth. Contrast MRI of the head showed a large encapsulated, soft tissue mass occupying the subgaleal layer of the right parietotemporooccipital region, measuring 14x10x14 cm (APxTxCC), which exhibits heterogeneous enhancement with areas of restricted diffusion. Patient was referred to interventional radiology for pre-operative embolization. Embolization using polyvinyl alcohol (PVA) and gelfoam was done which showed complete obliteration of the vessels supplying the tumor: superficial temporal, posterior auricular and occipital branches of the right external carotid arteries. Within 48 hours post-embolization, the patient then underwent wide excision of the mass with only 250 cc blood loss and 3 hours operating time. Histopathology of the mass yielded angiosarcoma. Angiosarcoma is a very aggressive tumor and its management is complex which needs a multidisciplinary approach. Local tumor control is the primary goal of treatment with wide excision of the mass done in most cases. The main goal of pre-operative embolization is to devascularize the tumor prior to surgical resection which results to lower intraoperative blood loss and post-operative blood transfusion requirement. Adjuvant chemotherapy and radiation therapy may be recommended for extensive lesions with established metastases.

Conclusion:
Pre-operative embolization for angiosarcoma is essential prior to surgery since it reduces intra-operative blood loss and the need for postoperative blood transfusion. It should be considered for resections of highly vascular tumors such as angiosarcoma.

EP11

PSEUDOMYXOMA PERITONEI MIMICKING RUPTURED LIVER ARTERIOVENOUS MALFORMATION – AN UNCOMMON PRESENTATION OF A HIGH GRADE LIVER SARCOMA

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Introduction:
Pseudomyxoma peritonei is characterized by accumulation of mucinous ascites within the peritoneal cavity and it is commonly associated with an underlying mucinous carcinoma. Scalloping of the liver margin is common but it is very uncommon to cause abnormal liver angiogenesis. This case report is to highlight the unusual presentation of pseudomyxoma peritonei in a case of high-grade liver sarcoma, mimicking ruptured arterio-venous malformation(AVM).

Case report:
A 44-year-old gentleman presented to the emergency department with 1-month history of anemia and abdominal discomfort. Examination revealed a cachexic patient with a distended abdomen and right hypochondriac tenderness. Initial multiphase CT Liver showed multiloculated low attenuation fluid in peritoneal cavity with scalloping of segment VII liver surface along with a feeder vessel from right posterior segmental hepatic artery. Angiography confirmed the feeder vessel arising from segment VI and VII with active blush suggestive of acute bleed. The initial impression was ruptured liver arteriovenous malformation or ruptured liver tumor with hemoperitoneum. Selective angioembolization of right segmental hepatic artery was done with Polyvinyl alcohol. Patient was then discharged well. Repeated CT liver a month later revealed enlarging perihepatic soft tissue mass with complex vascular structures. Repeated angiogram showed more prominent serpiginous vessel with a pseudoaneurysm outside the liver parenchyma despite previous angioembolization. Pre-op embolization was performed using 30% Histoacryl. Wide local segment VI and VII liver resection was performed, and large amount of mucinous material evacuated. Histopathological examination revealed a high grade sarcoma.

Conclusion:
This is a rare case of high grade liver sarcoma with pseudomyxoma peritonei, which was initially mistaken as a ruptured liver AVM. Pseudomyxoma peritonei are usually hypovascular. In the presence of abnormal vessels and close proximity with the liver, a ruptured high grade liver sarcoma with pseudomyxoma peritonei should be considered.

EP12

RUPTURED CYSTIC ARTERY PSEUDOANEURYSM AS A COMPLICATION OF ACUTE CALCULOUS CHOLECYSTITIS – A CASE REPORT

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Introduction:
Cystic Artery Pseudoaneurysm is an extremely rare entity. The majority of cases were reported as post-operative complication of laparoscopic cholecystectomy, however there are also a few cases associated with acute cholecystitis or pancreatitis. Patients with Cystic Artery Pseudoaneurysm may be asymptomatic or present with hemobilia with the clinical triad of jaundice, upper abdominal pain and obscure upper gastrointestinal bleeding knows as "Quincke's triad". Rarely, it may also present with a torrential, life threatening gastrointestinal haemorrhage.

Case Report:
We report a case of a 60-year-old man with underlying Ischaemic Heart Disease and Bronchial Asthma who presented with sudden onset severe epigastric pain, melaena and haematemesis. With the suspicion of an upper gastrointestinal bleed due to perforated gastric or duodenal ulcer, the patient underwent an emergency Oesophagogastroduodenoscopy (OGDS) which showed haemobilia however the source of bleeding could not be identified. An emergency multiphase Computed Tomography confirmed a ruptured cystic artery pseudoaneurysm with concurrent acute calculous cholecystitis. The pseudoaneurysm was subsequently managed via endovascular intervention and an elective laparoscopic cholecystectomy 2 weeks later. The patient made an uneventful recovery and was seen well in clinic 2 months later.

Conclusion:
Cystic artery pseudoaneurysm is very rare, nonetheless it should be considered in patients presenting with symptoms of upper gastrointestinal bleed. It has previously mainly been treated by open cholecystectomy plus ligation of the cystic artery. However, there has been increasing reports in literature proposing various other treatment strategies including radiological selective embolization and coiling as well as a two-step approach involving radiological management of the pseudoaneurysm followed by an elective cholecystectomy. Furthermore, these endovascular options could help to reduce the risks and morbidity associated with open surgery in high-risk patients such as in our case.

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EP13

PULMONARY ARTERY ANEURYSM – TO GLUE OR TO COIL?

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Introduction:
Haemoptysis is a striking and alarming symptom which has an extensive array of aetiologies. Further evaluation is often warranted to look for life-threatening conditions in the event of severe haemoptysis. Pulmonary artery aneurysm is one such rare aetiology in which urgent intervention is required. Here, we describe a case of pulmonary artery aneurysm secondary to a lung abscess, and our corresponding endovascular treatment approach and its challenges.

Case Report:
Our patient is a previously well 31-year-old gentleman who presented with a 5-day history of productive cough and pyrexia, as well as onset of frequent moderate haemoptysis since day 4 of illness. These symptoms were associated with exertional dyspnoea and right sided pleuritic chest pain. Computed tomography (CT) angiogram of the thorax revealed a pulmonary artery aneurysm within a lung abscess cavity in the right lower lobe. Initial approach to embolise the aneurysm via non-targeted coil deployment was unsuccessful due to technical challenges in reaching the desired location. Subsequent attempt via glue embolization was successful, albeit complicated with moderate glue dispersion into branches of the posterior segmental right lower lobe artery. Immediately post-procedure, the patient reported minimal residual haemoptysis with complete resolution in 2 days. A repeated CT angiogram later shows a residual aneurysm with partial enhancement, and decision was made for conservative management and allow for spontaneous thrombosis of the aneurysm sac.

Conclusion:
Our case highlights the respective advantages and disadvantages of endovascular coiling and glue embolization in the management of pulmonary artery aneurysm, especially in terms of technical difficulties and procedural complications.

EP14

ENDOVASCULAR MANAGEMENT OF A MURAL TYPE OF VEIN OF GALEN MALFORMATION IN A 5 YEAR OLD, FILIPINO CHILD WITH DEVELOPMENTAL DELAY AND SEIZURES: A CASE REPORT

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Introduction:
Vein of Galen malformations (VGOMs) are rare congenital vascular malformation in the pediatric population, accounting for less than 1% of all intracranial vascular malformations. The primary pathology of a VGOM is a high flow arteriovenous fistula with direct choroidal artery drainage into the median prosencephalic vein, which is the precursor of the vein of Galen. There are only few cases reported in literature of VGOMs in early childhood with developmental delay and seizures. This study aims to present a case of a mural type of VGOM, along with its clinical presentation, diagnosis and endovascular management.

Case Report:
A 5 year old, Filipino female, presented with developmental delay and seizures. Cranial MRI showed a Vein of Galen malformation with a dilated median prosencephalic vein. 6-vessel conventional angiogram with digital subtraction angiography confirmed a mural type of VGOM supplied by posterior choroidal arteries on both sides. Staged transarterial embolization of the feeding vessels of the VGOM using coils and Onyx glue were done which resulted in partial occlusion, marked slowing of flow and reduction in the diameter of the dilated median vein. Patient had no complications post-operatively with resolution of seizures.

Conclusion:
Before the advent of endovascular therapy, the prognosis of Vein of Galen malformations was very poor with 100% mortality for patients who did not undergo treatment and 90% mortality following surgical intervention. Given the complexity of managing this disease, endovascular management combined with a multidisciplinary approach is strongly recommended for it can significantly lower mortality and can result in improved neurologic outcomes in these patients.

EP15

PERCUTANEOUS COIL EMBOLISATION OF HEPATIC ARTERY MYCOTIC ANEURYSM

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Introduction:
Mycotic hepatic artery aneurysm is a rare but recognized complication of bacterial endocarditis. Therapeutic options include open surgery, endovascular embolization/ stent placement, medical therapy, or a combination of these. Although transarterial endovascular embolization has been described in the literature as the mainstay of treatment, percutaneous embolization can be an effective alternative. We hereby report a unique case of a patient with Methicillin-susceptible Staphylococcal Aureus (MSSA) bacterial endocarditis acutely presented with mycotic hepatic aneurysm and biliary obstruction.

Case Report:
A 43-year-old immunocompromised gentleman with recurrent infective MSSA bacterial endocarditis presented with jaundice, tachypnoea and lower limb oedema. Blood profile was deranged with low haemoglobin, normal white cell count, hyperbilirubinemia and elevated liver enzymes. Multiphasic CT liver revealed right hepatic artery pseudoaneurysm, measuring 1.5x1.7x1.8cm (AP x W x CC) causing intrahepatic duct obstruction. Multiple failed attempts to cannulate coeliac trunk during transarterial hepatic artery embolization. Subsequently, patient underwent percutaneous transhepatic biliary drainage to create a window for percutaneous transhepatic coiling embolization. A total of 14 fibered coils were deployed into the aneurysm via a 21-gauge Chiba needle under direct ultrasound guidance, confirmed with transarterial angiogram. The procedure was well tolerated with no immediate complications or recurrence of pseudoaneurysm during follow up.

Conclusion:
Early diagnosis and aggressive treatment is the key to determine successful outcome. Treatment needs to be individualized and can be technically difficult owing to preexisting patient comorbidities, associated complications and compliance issues. In this case, we demonstrated an alternative and effective method in treating mycotic hepatic pseudoaneurysms.

EP16

HEPATIC FALCIFORM ARTERY AS AN ANATOMICAL VARIANT AND ITS CLINICAL SIGNIFICANCE IN CHEMOEMBOLISATION

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Introduction:
The authors present a case that accentuates the anatomy of the hepatic falciform artery with a prevalence of 2% and it is the second most common non-hepatic artery which arises from the hepatic vasculature. The hepatic falciform artery is an anatomical variant which has arterial communication between the liver and the anterior abdominal wall. It commonly arises from the middle hepatic artery (56%) and runs an extrahepatic course in the falciform ligament and provides blood supply to the periumbilical region.

Case Report:
A 47 year old Malay gentleman with underlying Diabetes Mellitus and Hepatitis B was first diagnosed with Hepatocellular Carcinoma upon screening for hepatitis. Initial CT scan showed liver cirrhosis with portal hypertension and a suspicious liver lesion. MRI then confirmed the findings of a segment IVa liver lesion suggestive of hepatocellular carcinoma. This gentleman was subsequently scheduled for transcatheter arterial chemoembolisation (TACE) to the segment IVa liver lesion.
During treatment, the hepatic falciform artery was identified on angiography as it arises from the middle hepatic artery. The middle hepatic artery arises from the right hepatic artery and gives off the segment IV hepatic artery. CT scan of the hepatic artery further confirmed this finding. The segment IV hepatic artery was superselectively cannulated and infused with Lipiodol instead of chemotherapy agent due risk of non-targeted chemoembolisation to the anterior abdominal wall and umbilicus. A total of 5 mls of Lipiodol was infused with good tumour uptake. No abdominal wall injury occurred post procedure.

Conclusion:
Upon identification of the hepatic falciform artery, it can be prophylactically embolised prior to transcatheter arterial chemoembolisation to reduce the risk of supraumbilical rash and necrosis. Thus, it is vital to identify the presence of this artery prior to embolisation or surgery to this region.

EP17

PERCUTANEOUS TRANSHEPATICCHOLECYSTIC PLACEMENT OF UNCOVERED STENT IN THE COMMON BILE DUCT AND PERCUTANEOUS CHOLECYSTOMY TUBE INSERTION

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Abstract:
We report the case of 53 years old female patient with pancreatic neoplasm causing obstructive jaundice. The patient's general condition did not permit for endoscopic approach and obstruction that not associated with intrahepatic duct dilatation, prohibited hepatic puncture. Therefore, the transhepaticcholecystic approach was used for placement of 10m x 60mm (Taewoong) Self Expandable Fully Uncovered Stent in the distal common bile duct. No post-procedural complication. Patient was referred to the oncology team for neoadjuvant chemotherapy in view of locally advanced neoplasm and planned for operation by hepatobiliary team later. Transhepaticcholecystic approach is an alternative approach route for biliary intervention when transhepatic approach is not feasible, even in cases where placement of uncovered stent is considered necessary.

EP18

CRYOABLATION AS AN EFFECTIVE TREATMENT FOR LUNG METASTASES SECONDARY TO UNDIFFERENTIATED SOFT TISSUE SARCOMA

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Introduction:
Pulmonary metastectomies have been the standard of care for oligometastatic lung disease but many patients are not surgical candidates due to disease burden, lesion location, or overall patient condition. Image-guided thermal ablation including cryoablation has proven to be a valid treatment alternative. Cryobalation generates sub-zero temperatures forming an ice ball to cover the tumor and safety margin at − 40° C. Cytotoxic cell destruction is achieved at temperatures below − 20° C.

Case Report:
60-year-old man presented with right thigh tumour, which was diagnosed as undifferentiated sarcoma. Multiple resections of tumours at right thigh and right inguinal region were done due to recurrence. After five years, patient was found to have five new lung nodules; one at upper lobe and four at lower lobe. Patient underwent a pulmonary metastatectomy and a video-assisted throracoscopic surgery (VATS) for the lower lobe nodules over the span of two years. The multidisciplinary team decided for cryoablation of the two remaining nodules to be done on two separate sessions. Nodules were 2.6cm and 3.0cm at lower and upper lobe, respectively. Two cryoprobes and triple-freeze ablation protocol were used for each nodule. PET-CT post-procedure showed no uptake. Latest CT at 18 months post-cryoablation for lower lobe nodule and 6 months for upper lobe nodule showed progressive reduction in size of the treated areas. Patient remained disease free until 2 years after the first cryoablation where he developed brain metastases.

Conclusion:
Advantages of cryoablation include repeatability, sparing of normal lung parenchyma and the ability to visualize the ablation zone in near real time. Most common complication is pneumothorax requiring chest tube placement. Post-ablation scars are variable in appearance on CT, but successful ablation results in stable or decreasing size of the post-ablation scar over time.

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SUPER-SELECTIVE TRANSARTERIAL GLUE EMBOLIZATION (TAGE) OF ACQUIRED UTERINE ARTERIOVENOUS MALFORMATIONS (AVMS) - A CASE REPORT

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Introduction:
Uterine arteriovenous malformations (AVMs) are abnormal communications between uterine arteries and uterine veins, which can be congenital or acquired. Congenital uterine AVMs are extremely rare whereas acquired uterine AVMs are relatively common. Acquired uterine AVMs are commonly associated with uterine trauma/ surgery (dilatation and curettage post miscarriage, caesarean section or other pelvic surgeries), infection, gynaecological malignancies, gestational trophoblastic disease (GTD) and exposure to diethylstilboestrol. Recent advances have demonstrated that transarterial embolization is the preferred treatment for uterine arteriovenous malformations as compared to hysterectomy with the advantages of being minimally invasive and the potential to preserve fertility.

Case Report:
A 41 years old lady, post evacuation of retained product of conception (ERPOC) for septic miscarriage, presented with excessive vaginal bleeding that required multiple blood transfusions. MRI and MR angiography of the pelvis showed left sided uterine hematoma with enlarged serpentine vessels arising from the left uterine artery, suggestive of left uterine AVM. Patient underwent left uterine artery embolization. Pre-embolization angiogram confirmed the diagnosis of left uterine AVM with demonstrable arterial feeder from the left uterine artery and drainage via bilateral uterine veins. The arterial feeder of left uterine AVM was super-selectively cannulated and embolized with diluted glue (N-butyl-cyanoacrylate) mixture. Immediate complete obliteration of AVM was achieved with preservation of non-feeder branches of left uterine artery, resulting in significant reduction of vaginal bleeding.

Conclusion:
Uterine AVM is a rare complication of ERPOC or other pelvic surgeries which may cause massive or life-threatening bleeding. Early recognition is crucial and it necessitates a high level of suspicion. Super-selective trans-arterial glue embolization (TAGE) is a fast and cost-effective treatment option for uterine AVM with the advantage of preserving fertility of patient.

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