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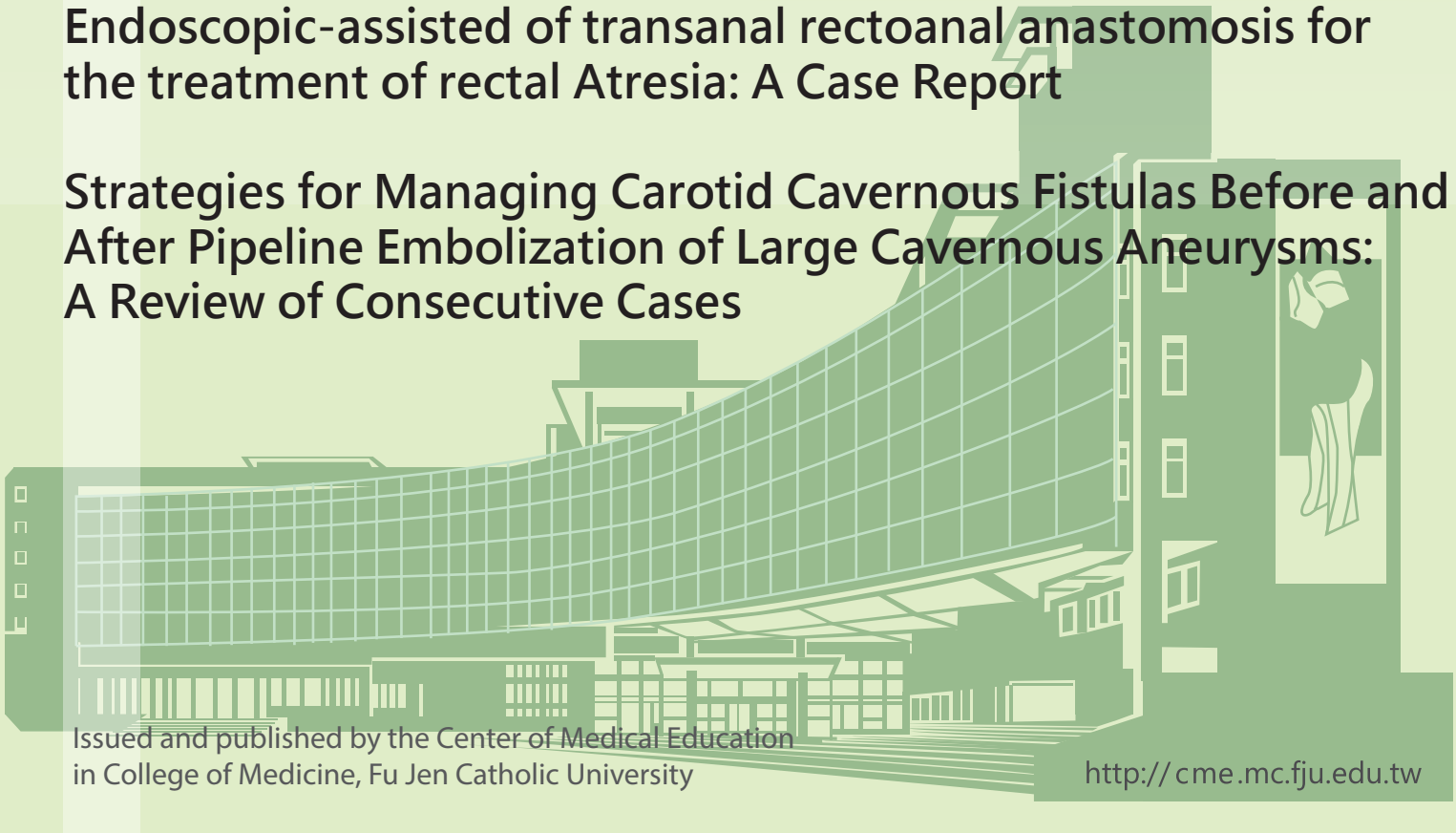

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Original Research Article

Salivary Cortisol, Mental and Physical Health, and Marital Status: Key Determinants of Sleep Health in Hemodialysis Patients

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ABSTRACT

Background: Sleep disturbances are highly prevalent among hemodialysis patients, leading to severe health consequences such as impaired immunity, increased inflammation, higher mortality risk, and reduced quality of life. However, the interplay between physical health, psychological distress, and personal factors in sleep disturbances remains unclear. This study examines the impact of these factors on sleep disturbances in hemodialysis patients. ***Methods:*** From November 2020 to January 2021, 138 hemodialysis patients were recruited. A structured questionnaire assessed basic attributes, clinical characteristics, psychological distress (BSRS-5), and sleep quality (CPSQI). Salivary cortisol levels were measured to evaluate physiological stress responses. Logistic regression analysis was performed to identify factors associated with sleep disturbances. ***Results:*** Among participants, 81.2% reported sleep disturbances. Psychological distress (BSRS-5 mean: 4.1 ± 3.8) was prevalent, with 29.0% experiencing significant distress. Logistic regression analysis identified psy-

chological distress (*OR* = 2.07, 95% *CI* = 1.36–3.15, *p* = .001) and marital status (*OR* = 0.22, 95% *CI* = 0.67–0.74, *p* = .014) as key factors influencing sleep disturbances. ***Conclusion:*** Psychological distress and marital status play a more significant role than physical health in sleep disturbances among hemodialysis patients. These findings emphasize the need for psychological support and social interventions to improve sleep quality and overall well-being in this population. Future research should explore long-term strategies to mitigate sleep disturbances in hemodialysis care.

Keywords: Hemodialysis, Sleep disturbance, Psychological distress, Salivary cortisol, Marital status, Public health

INTRODUCTION

The number of people suffering from end-stage renal disease in countries around the world is increasing every year[1]. Approximately 120,000 people in Taiwan receive dialysis treatment, 90% of whom receive hemodialysis treatment. In 2018, the total expenditure was 108.8 billion New Taiwan dollars, which is one of the major medical expenditure items of the National Health Insurance Administration[2]. The utilization of medical resources for chronic kidney disease is also an important issue in national health care systems worldwide.

Sleep has a crucial role in neuro-immune-endocrine balance, and insufficient sleep is associated with an increased risk of cognitive and emotional disturbances[3]. Chronic sleep disturbance can lead to decreased immune function, inflammatory responses, and an increase in a variety of diseases with an inflammatory component, including obesity, type 2 diabetes, cardiovascular disease, chronic pain disorders, some forms of cancer, and neurodegenerative diseases, leading to serious consequences such as increased mortality and decreased quality of life[4, 5, 6]. Sleep disturbance is often associated with physical, neurological or psychological problems[7].

Sleep disturbance is a common complaint of hemodialysis patients, and its incidence is as high as 60%-80%[8, 9, 10] and even as high as 90%[11]. The most common types of sleep disturbance in hemodialysis patients are waking at night or in the early morning, difficulty falling asleep, nightmares, and excessive daytime sleepiness. The average sleep latency is long, with an average of 42 minutes, and the average sleep time is less than 6 hours. The most common causes of sleep disturbance are snoring, pain and breathing problems. Only 9.2% of individuals use drugs to fall asleep[12].

Hemodialysis patients need to rely on replacement therapy to live, but long-term sleep disturbance affect their physical and mental health, which in turn affects medical resources and social productivity[13, 14]. Therefore, we aimed (1) to understand the personal attributes, clinical characteristics, psychological distress and sleep disturbance of hemodialysis patients and the factors that affect sleep disturbance and (2) to explore the important factors that affect sleep disturbance in hemodialysis patients.

MATERIALS AND METHODS

This was a cross-sectional study with a convenience sample, and the IRB approval number is FJUH-109025. The Gpower 3.1 software package (version 3.1.9.7) from California, USA was used to estimate effect size, which was 0.15[15], α=.05, number of predictors=7 and power=.80, and the number of samples was 93. From November 2020 to January 2021, a total of 8 hemodialysis interventions were employed and 138 completed questionnaires were collected.

The inclusion criteria were as follows: (1) patients aged 20 to 65 years old; and (2) patients diagnosed with end-stage renal disease by a nephrologist and had received regular hemodialysis for more than three months, two or three times a week, three to five hours each time. The exclusion criteria were (1) hospitalized patients due to infection or surgery and (2) patients with severe cognitive impairment who could not communicate or cooperate with the study.

Measurements

This study used a structured questionnaire with items including basic attributes, clinical characteristics, and psychological distress and sleeps disturbance factors and examined the patients' salivary fluid cortisol levels before hemodialysis at seven to eight o'clock in the morning.

Basic attributes:

Sex, age, occupation, exercise habits, education level, marital status, and nursing home.

Clinical characteristics:

Physical disease characteristics, hemodialysis (HD) status, clinical test values and physical symptoms.

(1) Physical disease characteristics: Primary disease, time and frequency of each dialysis session, years of dialysis, and physical symptoms.

(2) HD status: HD time (hours), weekly frequency of dialysis, and duration of HD (years).

(3) Clinical test values: Hemoglobin (HB), albumin, calcium (Ca), phosphorus (P), blood urea nitrogen (BUN), and dialysis volume (KT/V) recorded in medical records and salivary fluid cortisol (SFC) levels between seven and eight in the morning.

(4) Physical symptoms: The Physical Symptom Distress Scale (PSDS) developed by Taiwanese Dr. Qiu Zhouping was used to evaluate the physical symptoms in the areas of fluid and electrolyte imbalance and neuromuscular dysfunction. There were sixteen symptoms in total. Scores ranged from zero to sixty-four, based on symptom severity: zero (nothing at all); one (slightly); two (moderate); three (very severe); four (extremely severe). Higher scores indicated more types and severity of symptoms, with a Cronbach's alpha of 0.87 to measure internal consistency and a test-retest reliability of 0.82[16]. In a systematic review of the literature on the use of the Physical Symptom Assessment Scale, the PSDS was specifically developed for people with dialysis, with both reliability and validity values of ≥ 0.70, and the scale could be completed within five minutes[17]. In previous studies, Cronbach's alpha was 0.93[18]. Cronbach's alpha in this study was 0.89.

Psychological distress:

The five-item Brief Symptom Rating Scale (BSRS-5) was used to assess the degree of psychological distress, which was revised by Taiwanese professor Li Mingbin[19]. As a simple screening test for mental state, the BSRS-5 can quickly screen the degree of mental illness and psychological distress and has been widely used in medical and community settings; domestic scholars have used the simplified health scale to study the relationship between psychological distress and angina pectoris, with a Cronbach's alpha of 0.85; the BSRS-5 is a clinically convenient screening tool for psychological distress, and a total score greater than 6 is defined as psychological distress[20]. The BSRS-5 scale is also used to treat emotional distress in cancer patients[21]. The BSRS-5 mainly evaluates five symptoms of psychological distress, including anxiety, anger, depression, low self-esteem, and sleep disturbance. Four grades, 0 to 5 points, represents good physical and mental adjustment; 6 to 9 points represents mild emotional distress; 10 to 14 points represents moderate emotional distress; and more than 15 points represents severe emotional distress. Cronbach's alpha in this study was 0.88.

Sleep disturbance:

The Pittsburgh Sleep Quality Index (PSQI) revised from the original Pittsburgh Sleep Quality Index[22] translated and revised Chinese version by Dr. Tsai (CPSQI,[23] , sleep quality within the last month and seven dimensions of sleep quality, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction, were assessed. The scores ranged from 0 to 21, with higher scores indicating poorer sleep quality and a total score greater than 5 indicating sleep disturbance[24]. In past research on the sleep quality of hospitalized dialysis patients, Cronbach's alpha for measuring internal consistency reached 0.91[25]. In this study, Cronbach's alpha was 0.85.

Ethical considerations

The researchers explained the purpose and methods of the study to the subjects and accepted the cases after the subjects signed the informed consent form. Participants can terminate the study at any time, and the questionnaire data will be encrypted and anonymized.

Statistical Analyses

Descriptive and inferential statistical analyses of basic attributes, clinical characteristics, physical disease characteristics, psychological distress, salivary fluid cortisol, and sleep disturbances were performed with the IBM SPSS version 25.0 statistical software package (IBM Corporation, USA). The variables that were significantly related to sleep quality were then included in the logistic regression analysis to analyze important influencing factors. All statistical significance levels were set at p values less than 0.05.

RESULTS

The sample of this study was 77 males (55.8%) and 61 females (44.2%) aged between 28 and 65 years with an average age of 53.20 (±8.6) years. Patients who were unemployed (89 people, 64.5%), had exercise habits (77 people,

55.8%), had a high school education (80 people, 58.0%), were married (73 people, 52.9%), and were not living in a nursing facility (127 people, 92.0%) accounted for the majority; see Table 1 for details.

The CPSQI score was divided into a variable that included sleep disturbance (CPSQI ≥6) and a variable that did not include sleep disturbance (CPSQI < 6). Ultimately, 112 people (81.2%) in this study had sleep disturbance, and the sleep disturbance rate among nonworkers (87.6%) was significantly higher than that among workers (69.4%); the sleep disturbance rate was significantly higher among those who were not married (89.2%) than among those who were married (74.0%), and there was no statistically significant difference in the rate of sleep disturbances for other basic attributes, as shown in Table 1.

Most of the patients in this study had diabetes mellitus, renal hypertension, glomerulonephritis, systemic lupus erythematosus and other diseases, with diabetes and hypertension being the most common (50 people, 36.2%). The average dialysis time per dialysis session was 4.0 (±0.2) hours, the average dialysis frequency was 3.0 (±0.2) times per week, and the average dialysis duration was 5.1 (±5.2) years (44.9%). According to the analysis of sleep disturbance, there was no statistically significant difference between the characteristics of physical disease, dialysis time, dialysis frequency, and dialysis duration, as shown in Tables 1 and 2.

The average hemoglobin level in this study was 10.3 (±1.4) g/dl, the average albumin level was 4.1 (±0.4) mg/dl, the average calcium level was 9.2 (±0.9) mg/dl, the average phosphorus level was 5.5 (±1.5) mg/dl, the average BUN level was 80.6 (±16.8) mg/dl, the average dialysis volume (KT/V) was 1.4 (±0.3), and the average salivary fluid cortisol level was 0.6 (±1.2) μg/dL. According to the analysis of sleep disturbance, the hemoglobin levels of patients with sleep disturbance were significantly lower than those of patients without sleep disturbance (t = 2.08, p =.040). Clinical test values of patients with sleep disturbance, such as albumin, calcium, phosphorus, BUN, dialysis volume (KT/V), and salivary fluid cortisol, were not related to those of patients without sleep disturbance. There were significant differences in the clinical test values of the patients, as shown in Table 2.

The average total score of physical symptoms of the sample in this study was 13.0 (±9.6). According to the analysis of sleep disturbance based on yes (CPSQI score ≥6) or no (CPSQI score <6) responses, the total score of physical symptoms of patients with sleep disturbance was significantly higher than that of patients without sleep disturbance (t = -4.21, p <.001), indicating that sleep disturbance scores among hemodialysis patients were significantly higher; see Table 2 for details.

The average total score of psychological distress in this study sample was 4.1 (±3.8) points. In terms of psychological distress, most patients had good psychological adaptation (98 patients, 71.0%), but 27 patients (19.6%), 10 patients (7.2%), and 3 patients (2.2%) had mild, moderate and severe psychological distress, respectively. A total of 74.5% of those with good psychological adjustment had sleep disturbance, 96.3% of those with mild psychological distress had sleep disturbance, and 100% of those with moderate and severe psychological distress had sleep disturbance. Yes (CPSQI score ≥ 6) and no (CPSQI score<6) responses in the sleep disturbance analysis found that the total score of psychological distress among patients with sleep disturbance was significantly higher than that among patients without sleep disturbance (t = -5.16, p <.001), indicating that sleep disturbance scores among hemodialysis patients with psychological distress were significantly higher, as shown in Tables 1 and 2.

Yes (CPSQI score ≥ 6) and no (CPSQI score < 6) responses to having sleep disturbance were dependent variables, and independent variables included employment status, marital status, hemoglobin, PSDS score, and BSRS-5 score. Attributes, clinical characteristics, and psychological distress were the three hierarchical models. Logistic regression analysis was used to analyze the important factors affecting sleep disturbance in hemodialysis patients.

The results show that in the first model that included basic attributes, employment status (OR = 3.06, p =.014) and marital status (OR = 0.35, p =.033) both significantly affected sleep disturbance in hemodialysis patients.

However, after clinical characteristics were added to the first model to obtain the second model, employment status no longer significantly affected sleep disturbance in hemodialysis patients, but marital status still significantly affected sleep disturbance in hemodialysis patients (OR = 0.22, p =.042), and the addition of psychological distress also significantly affected sleep disturbance in hemodialysis patients (OR = 1.05, p =.001).

After adding BSRS-5 scores to the first and second models to form the third model, marital status still significantly affected sleep disturbance in hemodialysis patients (OR = 0.22, p

=.014), and physical symptoms no longer significantly affected sleep disturbance in hemodialysis patients (*OR* =1.05, *p* =.405). The addition of the BSRS-5 scores significantly affected sleep disturbance in hemodialysis patients (*OR* = 2.07, *p* =.001).

After analyzing the three models, marital status and psychological distress significantly affected the sleep disturbance of hemodialysis patients. Being married was a protective factor for sleep disturbance, but psychological distress was a worsening factor for sleep disturbance, as shown in Table 3.

DISCUSSION

Compared with the physical health of hemodialysis patients, marital status and psychological distress had more influence on sleep disturbance. Sleep disturbance is a common complaint of hemodialysis patients. In the past, the reported rate of sleep disturbance among hemodialysis patients was as high as 60%-80%[9, 10] and even as high as 90% or more[11]. The sleep disturbance rate in this study was 81.2%, which is still within a reasonable range.

This study showed that unemployed patients accounted for 64.5%, and the sleep disturbance rate (87.6%) was significantly higher than that among those who were employed (69.4%), which was similar to the findings in Pakistan[25]. Research by Taiwanese scholars also showed that monthly income affects sleep quality[27]. Employment enables hemodialysis patients to maintain social status, self-independence, financial support, mental health, and sleep quality[28, 29].

Hemodialysis treatment can cause changes in marital roles, and patients facing marital problems experience stress, anxiety, and depression[30]. In this study, unmarried people accounted for 47.1%, and their sleep disturbance rate (89.2%) was significantly higher than that among married people (74.0%)[31].

There are individual differences in the physical symptoms of hemodialysis patients. Severe symptoms can affect sleep. Therefore, symptom management is a clinical problem that must be addressed. Active and regular screening of patients' symptoms is a feasible way to relieve sleep disturbance[32]. In this study, the hemoglobin levels of patients with sleep disturbance were significantly lower than those of patients without sleep disturbance, which is similar to the findings of the Turkish scholars Karatas et al.[33]. For the patient, dialysis is a long-term continuous treatment that lasts until death or dialysis is stopped, during which comorbidities and physical symptoms increase, such as the common problem of anemia, resulting in weakness, shortness of breath, headache, and mental distress and affecting sleep quality and increasing the risk of death[34, 35]. Patients with sleep disturbance are substantially more troubled by physical symptoms than those without sleep disturbance. Common physical symptoms of hemodialysis patients include pain and itchy skin[36, 37], restless leg syndrome[38], muscle spasms, inflammation[37] and other symptoms, which all affect the sleep quality of hemodialysis patients[12]. Actively improving the problem of anemia and providing active treatment and health education can alleviate the problems associated with sleep disturbance[39].

Hemodialysis patients suffer from chronic psychological distress due to symptomatic treatment burden, lifestyle restrictions, and the constant threat of death[40, 41]. In this study, hemodialysis patients experienced mainly mild distress (71.0%); regarding the sleep disturbance rate (74.5%), as the degree of psychological distress increased, the sleep disturbance rate also increased. This is similar to previous studies[40, 42].

According to the analysis of the three hierarchical models of basic attributes, clinical characteristics and psychological distress, the important factors affecting sleep disturbance in hemodialysis patients were analyzed. However, after adjusting for clinical characteristics, only those hemodialysis patients who were unmarried or had severe physical symptoms were significantly affected by sleep disturbance. After adding psychological distress, only those hemodialysis patients who were unmarried or had severe psychological distress were significantly affected by sleep disturbance. After analyzing the three models, it was found that marriage was a protective factor for sleep disturbance, but psychological distress was a worsening factor for sleep disturbance, and other clinical characteristics were not as influential as these two factors on sleep disturbance.

Marriage is a protective factor for sleep disturbance. The possible reason for this is that in a harmonious marital relationship, the partner acts as a buffer against physical and psychological stress, and the patient receives physical and psychological support from the partner. Sleeping with a partner is an expression of intimacy and attachment that helps in achieving restful sleep; in contrast, stressful relationships lead to an increased risk of sleep disturbances. There is a bidirectional relationship between marital status and sleep problems, and sleep disturbances may also negatively impact marital relationships[43].

Psychological distress has always been one of the important factors that affect sleep disturbance. Hemodialysis patients suffer from psychological distress for extended periods of time[40, 41, 44] and sleep disturbance for an extended period of time, as well[45, 38]. However, hemodialysis patients need better sleep quality to have better physical and mental health[18]. Due to the treatment relationship, hemodialysis patients spend a long time in the dialysis unit and have prolonged contact with medical staff. Patients tend to treat medical staff as relatives. Therefore, maintaining a good relationship with patients and providing psychological support is also a must for hemodialysis staff, who must possess caregiving skills[46]. Therefore, if the clinical staff and managers of hemodialysis clinics can pay attention to the psychological distress of hemodialysis patients, properly guide their emotions, actively help patients to overcome the low points of psychological distress, promote mental health, and improve sleep disturbance, hemodialysis care services can be improved.

CONCLUSIONS

In this study, 81.2% of hemodialysis patients complained of sleep disturbance. Unemployment, not being married, low hemoglobin levels, severe physical symptoms and severe psychological distress all significantly affected sleep disturbance in hemodialysis patients. However, when five factors were included in the analysis, only marital status and psychological distress were closely related to sleep disturbance. It is expected that this study will draw the attention of hemodialysis unit staff to hemodialysis patients who are not married or have serious psychological distress.

Limitations of this study

This study used a cross-sectional design to explore the important factors affecting sleep disturbance in hemodialysis patients, but knowledge of the long-term effects is limited. It is suggested that future researchers conduct long-term follow-up studies to explore the long-term effects of marital status, psychological distress and sleep disturbance. In addition, the patients in this study belonged to an Eastern culture. Marital status and psychological distress may be greatly affected by cultural and social factors, so it is suggested that future researchers include possible confounding variables to provide a more complete study explanation.

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ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The protocols performed in this study were in accordance with the Declaration of Helsinki and relevant guidelines and regulations. The data collection and analysis plan for this study has been approved by the Human Subjects Committee of Fu Jen Catholic University Hospital (No.: FJUH-109025). The informed consent was obtained from all or their legal guardians.

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TABLES

Table1. Distribution and comparison among hemodialysis patients with sleep disturbance (N = 138)

Variables	*M*	*SD*	*n* (%)	Sleep Disturbances CPSQI≧6 (*n*=112)	Sleep Disturbances Prevalence(%), 81.2	x^2	*p*
Gender						0.51	.662
Female			61(44.2)	51	83.6		
Male			77(55.8)	61	79.2		
Age(years)							
28-40			13(9.4)	11	84.6	2.05	.572
41-50			33(23.9)	24	72.7		
51-60			57(41.3)	48	84.2		
61-65			35(25.4)	29	82.9		
Employment status						6.89	.009
No			89(64.5)	78	87.6		
Yes			49(35.5)	34	69.4		
Exercise habits						1.19	.275
No			61(44.2)	52	85.2		
Yes			77(55.8)	60	62.5		
Educational levels						0.17	.682
Junior high school or lower			58(42.0)	48	82.8		
Senior high school or higher			80(58.0)	64	80.0		
Marital status						5.24	.022
No			65(47.1)	58	89.2		
Yes			73(52.9)	54	74.0		
Live in nursing Agency						2.78	.096
No			127(92.0)	101	79.5		
Yes			11(8.0)	11	100.0		
Primary cause						1.64	.802
Diabetes mellitus			27(19.6)	21	77.8		
Hypertensive renal disease			36(26.1)	30	83.3		
Diabetes and Hypertensive			50(36.2)	41	82.0		
Glomerulonephritis			23(16.7)	19	82.6		
Systemic Lupus Erythematosus			2(1.4)	1	50.0		
HD Time(hours)							
<4			8(5.8)	8	100	1.97	.160
≧4			130(94.2)	104	80.0		
Frequency of dialysis weekly							
<3			4(2.9)	2	50	2.62	.106
≧3			134(97.1)	110	82.1		
Duration of hemodialysis(years)							
0.3- 0.9			28(20.3)	24	85.7	1.69	.064
1.0-5.0			62(44.9)	51	82.3		
5.1-10.0			30(21.7)	22	73.3		
10.1-24.0			18(13.0)	15	83.3		
Psychological Distress (BSRS-5)							
No (BSRS-5 Scale:0-5)			98(71.0)	73	74.5	9.92	.019
Mild (BSRS-5 Scale:6-9)			27(19.6)	26	96.3		
Moderate (BSRS-5 Scale:9-14)			10(7.2)	10	100.0		
Severe (BSRS-5 Scale:>15)			3(2.2)	3	100.0		

Note. BSRS-5=The five-item Brief-Symptom Rating Scale. Sleep Disturbances (CPSQI) ≧6.

Table2. Distribution and relationship among hemodialysis patients with sleep disturbance (N = 138)

Variables	Total (N = 138)		Sleep Disturbances				*t*	*p*
			No (*n* = 26)		Yes (*n* = 112)			
	M	*SD*	*M*	*SD*	*M*	*SD*		
Age(years)	53.2	8.6	51.7	9.4	53.5	8.4	-0.99	.324
HD Time(hours)	4.0	0.2	4.0	0.0	4.0	0.2	0.20	.839
Frequency of dialysis weekly	3.0	0.2	2.9	0.3	3.0	0.1	-1.08	.290
Duration of hemodialysis(years)	5.1	5.2	5.0	4.3	5.1	5.3	-0.14	.886
Hemoglobin (g/dL)	10.3	1.4	10.7	1.6	10.1	1.3	2.08	.040
Albumin (g/dL)	4.1	0.4	4.1	0.5	4.0	0.4	1.56	.122
Calcium (mg/dL)	9.2	0.9	9.2	0.6	9.2	0.9	-0.38	.705
Phosphorus (mg/dL)	5.5	1.5	5.3	1.1	5.5	1.6	-0.74	.459
BUN (mg/dL)	80.6	16.8	84.7	19.1	79.6	16.1	1.42	.158
Dialysis adequacy (Kt/V),	1.4	0.3	1.5	0.3	1.4	0.3	1.58	.117
SFC (ug/dL)	0.6	1.2	0.4	0.2	0.6	1.3	-0.73	.467
Physical Symptom Distress Scale (PSDS)	13.0	9.6	6.2	5.7	14.5	9.7	-4.21	<.001
Psychological Distress (BSRS-5)	4.1	3.8	0.9	1.6	4.8	3.8	-5.16	<.001

Note. Sleep Disturbances (CPSQI) No=CPSQI<5, Yes=CPSQI≧6；BUN= Blood Urea Nitrogen；Dialysis adequacy (Kt/V) = Single-pool Kt/V；SFC= Salivary fluid cortisol；HD= Hemodialysis.

Table3. Influencing factors of the hemodialysis patients' sleep disturbances by logistic regression analysis (N = 138)

Variables	Model 1			Model 2			Model 3		
	OR	95%CI	*p*	OR	95%CI	*p*	OR	95%CI	*p*
Employment status	3.06	1.25-7.48	.014	3.01	0.70-5.09	.213	3.00	0.94-9.61	.064
Marital status	0.35	0.13-0.92	.033	0.22	0.12-0.96	.042	0.22	0.67-0.74	.014
Hemoglobin	-	-	-	0.80	0.54-1.18	.266	0.80	0.50-1.27	.341
Physical Symptom Distress Scale	-	-	-	1.05	1.08-1.31	.001	1.05	0.94-1.17	.405
Psychological Distress (BSRS-5)	-	-	-	-	-	-	2.07	1.36-3.15	.001

Note: Model 1 Personal Characteristics: Employment status and Marital status; Model 2: Model 1 and Clinical Characteristics: Hemoglobin, Physical Symptom Distress Scale (PSDS)； Model 3: Model1, Model 2 and Psychological Distress (BSRS-5)

Salivary Cortisol, Mental and Physical Health, and Marital Status: Key Determinants of Sleep Health in Hemodialysis Patients

唾液皮質醇、心理與身體健康及婚姻狀況：影響血液透析患者睡眠健康的關鍵因素

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中文摘要

背景：血液透析病人普遍存在睡眠障礙，可能導致免疫功能受損、炎症反應增加、死亡風險上升及生活品質下降。然而，身心健康與個人因素對睡眠障礙的影響尚不明確。本研究旨在探討這些因素對血液透析病人睡眠障礙的影響。**方法：**本研究於 2020 年 11 月至 2021 年 1 月招募 138 名血液透析病人，並透過結構式問卷評估其基本屬性、臨床特徵、心理困擾（BSRS-5）及睡眠品質（CPSQI）。此外，測量唾液皮質醇水平以評估生理壓力反應，並透過羅吉斯迴歸分析探討影響睡眠障礙的關鍵因素。**結果：**81.2%的受試者有睡眠障礙。心理困擾（BSRS-5）平均得分為 4.1 ± 3.8，其中 29.0%的病人經歷顯著的心理困擾。羅吉斯迴歸分析顯示，心理困擾(OR = 2.07, 95% CI = 1.36 – 3.15, p = .001)與婚姻狀態(OR = 0.22, 95% CI = 0.67 – 0.74, p = .014)為影響睡眠障礙的關鍵因素。**結論：**心理困擾與婚姻狀態對血液透析病人的睡眠障礙影響大於生理健康因素。本研究結果強調，應加強心理健康支持並考量社會因素，以改善此族群的睡眠品質與整體健康。未來研究應進一步探討長期介入策略，以減少透析病人的睡眠障礙。

關鍵字：血液透析、睡眠障礙、心理困擾、唾液皮質醇、婚姻狀態、公共衛生

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Original Research Article

Health Landscapes of Hemodialysis Patients

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ABSTRACT

The number of hemodialysis patients in Taiwan continues to rise, posing long-term physical and psychological challenges, particularly in depression development. This study explores the impact of natural landscapes (forests, farmlands, and coastlines) on the mental health of dialysis patients. Using in-depth interviews and content analysis, patients' landscape preferences were collected. A landscape intervention trial was conducted through 360-degree panoramic images and virtual reality to assess psychological and physiological benefits. Results indicate that most participants found viewing natural landscapes alleviated discomfort and depressive feelings during dialysis, with forests and coastlines being the most effective. These findings support landscape intervention as a potential adjunctive therapy to enhance the psychological well-being and quality of life of dialysis patients.

Keywords: Hemodialysis patients, landscape intervention, depression alleviation, virtual reality, health landscapes

INTRODUCTION

1.1 Background and Motivation

The number of hemodialysis (HD) patients in Taiwan has exceeded 90,000, with an annual treatment cost surpassing NT$50 billion, highlighting the substantial burden on the healthcare system (National Health Insurance Administration, 2023). HD patients endure long-term physiological discomfort, including fatigue, muscle cramps, pruritus, and insomnia, alongside significant psychological stress. Studies indicate that 60-70% of HD patients experience depressive symptoms, which not only reduce quality of life (QoL) but also increase the risk of mortality and cardiovascular diseases.

Previous research has demonstrated the psychological benefits of natural landscapes. Ulrich (1984) found that patients with access to natural views had shorter hospital stays and improved recovery rates. More recently, virtual reality (VR) technology has been integrated into psychological interventions, showing efficacy in reducing anxiety and stress through

exposure to natural environments. Studies suggest that VR-based nature exposure can enhance relaxation and alleviate discomfort, making it a promising non-pharmacological intervention for HD patients. This study aims to explore whether landscape interventions can effectively mitigate depressive symptoms and provide new therapeutic directions for dialysis care.

1.2 Depression and Quality of Life in Hemodialysis Patients

HD patients frequently experience depression due to prolonged treatment, lifestyle restrictions, and physiological distress, significantly impacting their QoL. Studies report a depression prevalence of 20-30% among HD patients, substantially higher than in the general population. Depression is closely linked to fatigue, poor sleep quality, and lack of social support. Furthermore, depressive symptoms can decrease treatment adherence and increase hospitalization and mortality rates.

QoL in HD patients is influenced by multiple factors, including disease-related pain and discomfort, the time commitment required for treatment, the strength of social support systems, and personal coping mechanisms. Research suggests that emotional support and health-promoting interventions can significantly improve QoL. Thus, identifying effective non-pharmacological strategies to enhance mental well-being has become a critical research focus.

1.3 Effects of Natural Landscapes on Psychological Health

Exposure to natural environments has been shown to reduce stress and improve mental health by alleviating anxiety and enhancing emotional stability. Studies indicate that viewing green spaces or coastal scenery through windows can lower anxiety levels in hospitalized patients. Among individuals with chronic illnesses, nature exposure is increasingly recognized for its benefits. Research has demonstrated that patients with kidney disease experience increased life satisfaction after engaging with nature, and HD patients who view natural landscapes report reduced depressive symptoms and improved QoL. Additionally, studies have found that viewing nature scenes can decrease cortisol levels, indicating reduced stress and anxiety.

1.4 Natural Environment Interventions for Hemodialysis Patients

Recent studies have explored incorporating natural elements into dialysis centers. Strategies such as placing plants in treatment rooms, playing nature sounds, or using windows to introduce natural light have shown potential in improving patients' emotional well-being. Research suggests that HD patients who view nature imagery during dialysis experience lower anxiety and pain perception. Furthermore, dialysis centers designed with open spaces and natural scenery can help alleviate psychological distress.

Different types of natural landscapes may have varying psychological effects. Studies indicate that forest landscapes are more effective than urban scenes in reducing anxiety and enhancing mood. Additionally, water-based landscapes, such as lakes or oceans, have been associated with heightened relaxation and well-being. These findings underscore the importance of integrating nature elements into dialysis care environments.

Given the high prevalence of depression among HD patients and its impact on QoL, incorporating natural landscape interventions—such as viewing greenery, coastal scenes, or listening to nature sounds—may serve as an effective strategy for improving mental health and overall well-being in dialysis patients. Future dialysis center designs should consider integrating natural elements to enhance patient care.

1.5 Objectives

1. To explore the psychological experiences and coping mechanisms of long-term HD patients.
2. To understand HD patients' preferences for different types of natural landscapes.
3. To assess the effects of landscape interventions on depressive symptoms and propose applications in clinical practice.

MATERIALS AND METHODS

2.1 Study Location

This study was conducted at the hemodialysis unit on the fourth floor of Fu Jen Catholic University Hospital. The unit is well-equipped, providing a stable environment for hemodialysis treatment, ensuring research feasibility and consistency. The dialysis space prioritizes patient comfort and safety, with designated treatment stations and television facilities. The selection of this site was based on the following criteria: (1) its resemblance to typical dialysis treatment settings, enhancing the generalizability of the results; (2) institutional support for patient recruitment and study coordination; and (3) the availability of audiovisual equipment necessary for landscape intervention implementation.

2.2 Participants

Participants were recruited based on the following inclusion criteria:

Undergoing hemodialysis three times per week to ensure a stable treatment environment for the intervention.

Aged between 50 and 70 years, ensuring adequate visual perception for immersive image experiences.

Receiving hemodialysis for at least six months to minimize confounding effects of sudden physiological changes.

Providing informed consent to participate in the study.

Exclusion criteria included severe visual impairment, neurological disorders, or conditions affecting image perception.

To ensure meaningful data collection, patients capable of articulating their experiences were prioritized. Medical personnel assisted in screening and inviting eligible participants.

2.3 Study Design

This study integrated qualitative interviews and immersive landscape experiences to examine the psychological impact of dialysis treatments. Previous research has highlighted the psychological benefits of nature exposure (Kaplan & Kaplan, 1989; Ulrich, 1991). Thus, this study explored patient preferences through in-depth interviews and implemented immersive visual experiences to optimize the dialysis environment.

The intervention involved 360-degree panoramic imagery, stabilized cinematography, and aerial footage, presented via VR headsets and LCD screens. The study hypothesized that exposure to such visual stimuli would alleviate patient anxiety and enhance subjective well-being.

2.4 Materials

2.4.1 Image Capture and Production

To ensure high-quality footage, a Sony FDR-AX100 digital camcorder with a handheld stabilizer was used for detailed close-up and mid-range shots. A RICOH THETA V 360-degree camera was mounted on a fixed stand to capture immersive environmental imagery. Additionally, a DJI MAVIC PRO drone equipped with the THETA V camera was employed for aerial landscape footage, overcoming ground-based visual limitations.

During recording, the research team sequentially operated the equipment based on the scene's requirements. Close-range footage was recorded using the Sony camcorder with stabilization adjustments. The 360-degree camera was placed strategically to capture comprehensive environmental views, ensuring smooth and distortion-free imagery. Aerial shots were taken at varying heights and angles, enhancing spatial perspective and visual appeal.

Selected natural landscapes, including forests, coastal areas, and mountainous regions, were filmed using 360-degree panoramic techniques. Factors such as lighting, color balance, and dynamic scene changes were considered to optimize visual effects. Patient interview findings informed landscape selection, ensuring alignment with patient preferences. Professional editing software was used to refine the footage, enhancing fluidity and color composition.

2.4.2 Video Editing and Production

Post-production involved processing raw footage, integrating ambient music and nature sounds to enhance immersion. Videos were shortened from 10–15 minutes to approximately 5 minutes, optimizing usability during dialysis sessions. Different video types were developed, allowing patients to select preferred landscapes for viewing.

2.4.3 Video Viewing Methods

1. Screen Viewing

In the screen-based mode, patients viewed 360-degree videos on computer monitors or tablets. They could adjust their viewing angles via touchscreen gestures, eliminating the need for head movement or additional equipment. This method minimized physical strain and allowed extended viewing. Playback controls enabled patients to replay or fast-forward specific segments for a personalized experience.

2. Head-Mounted Display (HMD) Viewing

In the VR mode, patients used HMD devices (e.g., VIVE PRO or Oculus Quest) for an immersive experience. After configuring the device, patients adjusted their perspective through head movements, enhancing the sense of presence. While this method offered greater immersion, adjustments were made to accommodate patient comfort and endurance. Post-viewing feedback was collected to refine future intervention strategies and device settings.

2.5 Data collection methods

2.5.1 Participant Interviews on Leisure Activity Preferences

1. Interview Procedure

This study employed semi-structured in-depth interviews to explore the leisure activity preferences of dialysis patients. Interviews were conducted at a time approved by

medical staff, ensuring participant comfort. Each session continued until data saturation was reached or the participant wished to discontinue. All interviews were audio-recorded and transcribed for content analysis.

Thematic analysis was conducted using an inductive approach, following Braun and Clarke's six-step framework. Initially, open coding was performed to identify emerging themes, followed by axial coding to establish relationships between themes. Data was manually coded and categorized using NVivo software to ensure systematic organization and traceability of the findings. To enhance reliability, two independent researchers coded the transcripts separately, and discrepancies were resolved through discussion.

2. Interview Structure

Two interviewers conducted sessions within a 45-day period, aiming to collect data from 30 participants. Each daily session was limited to four hours, with individual interviews lasting 20 to 60 minutes. The interviews took place in the dialysis center, accompanied by medical staff for participant comfort. Questions were asked in a conversational manner, ensuring flexibility in order and duration.

2.5.2 Immersive Experience Feedback Interviews

1. Interview Procedure

Following the immersive experience, participants were interviewed using a semi-structured approach. Interviews continued until saturation was reached or the participant chose to withdraw. Feedback was recorded and analyzed to assess the intervention's effectiveness.

RESULTS

Phase 1: Leisure Activity and Environmental Preferences

This study identified key patterns and factors influencing dialysis patients' leisure activities. Most participants previously enjoyed traveling and outdoor activities; however, dialysis treatment has significantly restricted their mobility, leading to a shift toward more sedentary pastimes such as shopping, family entertainment, and watching television. Some participants maintained mild outdoor activities like walking, light exercise in parks, or hiking, albeit at a reduced frequency.

Participants frequently used terms such as "happy," "exciting," "pleasant," and "relaxing" to describe their past leisure activities. For instance, Participant P3 stated, "I used to love exploring different places, enjoying the mountains and rivers—it always lifted my spirits." However, when discussing their current limitations due to dialysis, words like "helpless," "boring," and "restricted" emerged, highlighting the psychological impact of reduced mobility. Participant P8 remarked, "Now, I can only watch TV at home; I feel like a significant part of my life is missing."

Regarding environmental preferences, most participants favored mountain landscapes, citing fresh air and expansive views as psychologically soothing. Participant P7 noted, "Standing on a mountaintop and looking down makes my problems feel smaller." Some also expressed a preference for visiting temples, finding religious practices to provide inner peace and spiritual support. Additionally, many participants suffered from chronic conditions such as hypertension or diabetes and expressed nostalgia for the freedom of traveling before starting dialysis. Participant P3 shared, "I used to love traveling, visiting different places, and soaking in hot springs, but dialysis has made such trips difficult to arrange."

A subset of participants continued nighttime alcohol consumption, suggesting a need for healthier relaxation alternatives. Participant P21 mentioned, "Sometimes, I drink at night to unwind." This indicates that patients may benefit from guidance toward more health-conscious leisure options. Furthermore, different environmental elements influenced psychological states differently. Expansive landscapes, such as mountain peaks and coastlines, alleviated anxiety and provided comfort. Dynamic natural elements, such as flowing water, ocean waves, and gentle breezes, enhanced relaxation. Cultural and religious settings, such as temples and prayer rituals, offered psychological stability. In contrast, enclosed environments like dialysis rooms often induced feelings of boredom and confinement.

Healthier participants (those with greater mobility) were more inclined to explore new places and expressed a desire to resume hiking and traveling. For example, Participant P12 stated, "Although I get tired more easily now, I still try to go on short hikes to feel capable." In contrast, participants with greater physical limitations showed a "desire but inability to participate" sentiment, opting for alternative experiences such as watching nature videos or engaging in religious activities. Participant P22 remarked, "Now, I can only watch scenic videos—it's better than nothing." These findings suggest that immersive interventions, such as nature-based digital experiences, may provide

psychological benefits for mobility-impaired patients.

Phase 2: Perceptions of Immersive Experiences

Participants generally found VR technology intriguing, particularly when viewing nature scenes, with some describing the experience as reminiscent of outdoor travel. Participant P15 commented, "Although it's not the same as being in the mountains, VR still provides a relaxing effect." However, some reported that VR headsets were bulky and uncomfortable for prolonged use. Participant P10 noted, "Watching scenery in VR is nice, but wearing the headset for too long feels heavy—watching a regular screen is easier."

A few participants experienced dizziness while using VR, aligning with the Virtual Reality Sickness Theory. Participant P25 stated, "The visuals are stunning, but I felt dizzy—it might not be suitable for those with weaker health." These responses indicate that while VR can enhance immersion, its implementation in medical settings requires improvements in comfort and usability.

Due to physical limitations and adaptation issues, many participants suggested alternative delivery methods, such as displaying nature videos on large screens. Participant P13 stated, "VR visuals are beautiful, but long-term use is uncomfortable—perhaps not suitable for extended sessions." Similarly, Participant P25 added, "The headset feels heavy and puts pressure on my head; a lighter alternative would be better." These findings suggest that in medical applications, VR implementation should prioritize user comfort to minimize adverse effects.

Overall, participants were receptive to VR experiences, acknowledging their potential for relaxation and immersion but expressing concerns about comfort and usability. Future applications in medical settings may benefit from lightweight designs or mixed reality (MR) solutions that integrate real and virtual environments to enhance user experience.

DISCUSSION

4.1 Restorative Effects of Natural Environments

Dialysis patients frequently experience physical and mental fatigue during treatment. Research indicates that exposure to natural environments—particularly mountains and coastal settings—promotes psychological recovery. According to Attention Restoration Theory (ART), expansive natural landscapes and low-stimulation environments facilitate mental recovery by reducing stress and fatigue (Kaplan, 1995). Participants in this study consistently reported that green landscapes and open seascapes provided relaxation and emotional relief. These findings align with Herzog et al. (2019), who demonstrated that hiking significantly reduces emotional distress in chronic patients. Similarly, White et al. (2020) found that exposure to coastal environments improves well-being, especially for long-term patients. As Participant P9 reflected, "Every time I go hiking and see the distant mountains, I feel like I'm back to my healthier days."

Overall, dialysis patients' environmental preferences align with ART, suggesting that incorporating natural landscape interventions in hospital settings could enhance patients' quality of life.

4.2 VR Technology and Device Comfort

Despite the novelty of VR, its acceptance among dialysis patients is influenced by device comfort. Participants' responses were polarized—some appreciated the immersive effect, while others experienced discomfort due to headset weight and prolonged use. Research supports these concerns, indicating that extended VR sessions can cause dizziness, nausea, and visual fatigue (LaViola, 2000). Studies by Sharples et al. (2008) suggest that VR-related discomfort stems from factors such as device weight, visual latency, and refresh rates, with physically vulnerable users being more susceptible. Weech et al. (2019) further demonstrated that while VR can induce relaxation, poor ergonomic design may counteract its benefits by increasing fatigue.

To address these challenges, several potential improvements should be considered. Adjustable head straps and memory foam padding can enhance comfort by reducing pressure on the head and face. Additionally, alternative viewing modes, such as large-screen projections or augmented reality (AR) displays, may provide immersive experiences while minimizing physical strain. Future research should explore mixed reality (MR) solutions, allowing patients to interact with virtual environments while maintaining visual contact with their surroundings, thus mitigating the sense of isolation that full VR immersion may induce. Moreover, optimizing VR session duration and incorporating breaks could further reduce discomfort and enhance usability in medical applications. As Chirico et al. (2021) proposed, lightweight devices and high-resolution displays remain crucial for improving user expe-

rience, but additional ergonomic considerations and adaptive technology should also be prioritized to maximize VR's therapeutic potential in healthcare settings.

CONCLUSIONS

Findings indicate that dialysis patients overwhelmingly prefer restorative natural environments over virtual experiences, primarily due to nature's psychological benefits and VR's physical discomforts. While VR provides immersion, its usability challenges must be addressed before widespread adoption in healthcare. In contrast, integrating natural elements into hospital environments—such as windows with scenic views, indoor plants, or nature video projections—may offer a more accessible solution for patient relaxation.

Future research could explore mixed reality (MR) solutions, blending real-world environments with digital enhancements, to maximize the therapeutic effects of nature without full reliance on VR headsets. Additionally, further studies on lightweight VR equipment and optimized visual content may improve its feasibility for medical applications.

Overall, this study highlights the greater psychological benefits of direct exposure to nature compared to virtual substitutes. Healthcare institutions may consider prioritizing natural environment interventions to enhance patient well-being while continuing to explore the evolving role of immersive technology in medical settings.

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FIGURE AND FIGURE LEGENDS

Figure 1. Schematic diagram of image shooting tools and process

Figure 2. Schematic diagram of images viewed on screen

Figure 3. Viewing diagram of the head-mounted amplifier

Health Landscapes of Hemodialysis Patients

洗腎病患的健康地景

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中文摘要

台灣血液透析病患人數持續增加，對其生理與心理健康帶來長期影響，特別是憂鬱情緒的發展。本研究探討自然景觀（森林、田園、海岸）介入對透析病患心理健康的影響。透過深度訪談與內容分析，蒐集病患對戶外景觀的偏好，並運用 360 度全景影像與虛擬實境進行景觀介入試驗，以評估其心理與生理效益。結果顯示，多數受訪者認為觀看自然景觀可減輕透析期間的不適與憂鬱，尤以森林與海岸景觀效果最佳。研究結果顯示，景觀介入可作為未來輔助治療策略之一，以及作為輔助治療策略，以提升透析病患心理健康與生活品質。

關鍵字：洗腎病患、景觀介入、憂鬱改善、虛擬實境、健康地景

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Biopsy-Proven Ocular Sarcoidosis Appearing Isolated Anterior Uveitis in a Young Woman

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Case Report

Biopsy-Proven Ocular Sarcoidosis Appearing Isolated Anterior Uveitis in a Young Woman

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ABSTRACT

Background and purpose: To report a young lady presenting bilateral unique Koeppe's nodules without posterior involvement. Definite ocular sarcoidosis was diagnosed by biopsy-proven pathology. ***Methods:*** A retrospective case report. ***Results:*** A 38-year-old lady was sent to the emergency department because of general weakness and mild chest pain, and relief by supportive treatment without evidence of infectious activities or cardiac diseases. One week later, she complained of blurred vision OU presenting with bilateral distinct Koeppe's nodules and no posterior involvement. Best-corrected visual acuity was 6/30 OU. Topical and systemic corticosteroids were administrated for 3-4 weeks, and vision improved to 6/6.7 OU with the silent anterior chamber in both eyes. Ocular sarcoidosis was proven by lymph nodules biopsy with classic pathologic findings. ***Conclusions:*** Ocular sarcoidosis with isolated anterior uveitis is difficult to diagnose and seldom undergo biopsy with evidence of pathologic findings. Bilateral unique Koeppe's nodules appeared in a young lady, and clinicians should be aware of granulomatous anterior uveitis including ocular sarcoidosis.

Keywords: Ocular sarcoidosis; Anterior uveitis, Biopsy

INTRODUCTION

Sarcoidosis is a multi-organ inflammatory disease that mostly affects the lungs and lymph nodes with granuloma formation. While the prevalence of sarcoidosis was high up to 140-160 per 100,000 in Sweden and Canada, a relatively low prevalence of 2.2 per 100,000 was reported in Taiwan[1]. As for ocular involvement in sarcoidosis, prevalence varied from 13% to 79% in different studies, and uveitis was the most common feature in ocular sarcoidosis up to 30-70%[2].

In one Chinese study, only 2 cases (3.3%) of ocular sarcoidosis were reported with only anterior segment involvement[3]. An-

other Korean study reported that up to 22 of 104 (21.2%) sarcoidosis patients appeared with ocular involvement[4]. Moreover, isolated anterior uveitis appeared higher up to 58.8% in young individuals ranging from 19 to 39 years old. Here we reported a young woman presenting bilateral Koeppe's nodules with isolated anterior uveitis, which were diagnosed with definite ocular sarcoidosis by biopsy-proven pathology.

CASE REPORT

The 38-year-old lady complained of general weakness, fatigue, and mild chest pain for days, and was sent to the emergency department. On examination, the vital signs were stable, and the blood culture was negative. All the infectious serology was negative, and the finding of electrocardiography revealed normal. She felt better following the supportive treatment and was discharged with a stable condition. However, she suffered from blurred vision in both eyes one week later. Her best-corrected visual acuity was 6/30 OU. Slit-lamp examination revealed marked cells +++ and flares++ in both anterior chambers. Several unique Koeppe's nodules were revealed in the pupillary margins in both eyes (Figure 1A-B). In the right eye, many sticky whitish nodules appeared in the different sectors of pupil margins (Figure 1C-E, arrows). Three nasal pupillary nodules were also observed in the left eye (Figure 1F, arrows). However, fundoscopy showed quite clear (Figure 1G), and no marked leakage by fluorescein angiography in both eyes (Figure 1H). In summary, isolated granulomatous anterior uveitis without posterior involvement appeared in her both eyes.

Additional serologic tests for infectious uveitis caused by herpes zoster virus (HZV), herpes simplex virus (HSV), cytomegalovirus (CMV), toxoplasmosis, human Immunodeficiency Virus (HIV), tuberculosis (TB) and syphilis by venereal disease research laboratory (VDRL) were performed. The patient tested seronegative for HZV/HSV/CMV-IgM, toxoplasma, HIV, QuantiFERON-TB assay and VDRL was non-reactive. With the tentative diagnosis of non-infectious granulomatous uveitis, she was initially treated with topical 1% prednisolone acetate every 2 hours and oral 40 mg of prednisolone per day. Following 6 weeks of oral steroid treatment with gradual tapering and less frequency of topical steroid treatment, the best-corrected visual acuity improved to 6/6.7 in both eyes. Bilateral silent anterior chambers were observed without reactions, and fundus examination still revealed no vitreous opacities or vasculitis her both eyes. Because of initial systemic manifestations, mediastinal lymph nodule biopsies were performed. Histologic features show lymphoid tissue with poorly formed, non-necrotizing granulomas characterized by aggregates of epithelioid histiocytes and multinucleated giant cells (Figure 1I, arrows). Combined with ocular and systemic manifestations, this case was diagnosed with definite ocular sarcoidosis by the compatible pathologic findings. During the 3-month follow-up, her best-corrected visual acuity was 6/6 OU, and no recurrence of iritis was demonstrated.

This study was approved by Institution-al Ethics Review Board (permission num-ber: 20231005R).

DISCUSSION

According to the revised international workshop on ocular sarcoidosis criteria of ocular sarcoidosis, this case was classified as definite ocular sarcoidosis since the diagnosis was supported by biopsy with the presentation of uveitis. Her ocular presentations included Koeppe's nodules and bilaterality and two systemic investigations included negative QuantiFERON-TB assay and bilateral hilar changes. Most patients with sarcoidosis had initial symptoms of fatigue and general weakness such as our case at the time of diagnosis, probably caused by systemic inflammatory cytokines. However, it was difficult to make a prompt and accurate diagnosis of sarcoidosis with initial no-specific symptoms.

According to one Taiwan research in 2007, a total of 60 uveitis patients with biopsy-proven sarcoidosis were identified. Isolated anterior uveitis was found in only 2 cases up to 3.3%[3]. In another Taiwan investigation in 2022, up to 50% of panuveitis followed by posterior uveitis up to 42.6% are the most common form of sarcoidosis uveitis[1]. It would be difficult to make a diagnosis of ocular sarcoidosis with only isolated anterior uveitis, whereas only 6.6% anterior sarcoidosis uveitis was reported in this study. Regarding the distribution of age at diagnosis of ocular sarcoidosis, it had shifted towards the older age groups in developed countries. However, isolated anterior sarcoidosis uveitis was more commonly associated with younger groups in several studies[2,4]. Takayama et al. classified patients with ocular sarcoidosis into younger and older groups by the age of 65. The mean

ages of these 2 groups were 48.7 ± 11.6 and 72.8 ± 5.8 years old, respectively. Ocular manifestations in the anterior segment were up to 64% in younger groups compared to 40% in the elder group[2]. It indicated that the frequencies of anterior uveitis were significantly higher in younger patients than in elderly patients, and the frequencies decreased on an age-dependent basis in Japanese populations. Lee et al also reported similar findings in the Korean population[4]. In patients with ocular sarcoidosis ranging from 19 to 39 years old, up to 58.8% of individuals presented isolated anterior uveitis. Moreover, in ocular sarcoidosis cases with only anterior segment involvement, younger patients (58.8%) were significantly higher compared to posterior vasculitis groups (16.7%). The age distribution at the diagnosis of ocular sarcoidosis is biphasic for women. Some studies revealed that sarcoidosis onset could potentially be accelerated by insidious ovarian dysfunction associated with menopause, and endogenous female hormones could protect against the onset of sarcoidosis[5]. However, it required further study to investigate the potential pathogenesis in young ocular sarcoidosis patients appearing isolated anterior uveitis with hormone involvement or not.

Tissue biopsy is a useful method for the diagnosis of ocular sarcoidosis, although it is invasive and has some risks. Ocular sarcoidosis with isolated anterior uveitis is difficult to diagnose and seldom undergo biopsy with evidence of pathologic findings. Here we reported a young lady presenting unique bilateral Koeppe's nodules with isolated anterior uveitis, which were diagnosed with definite ocular sarcoidosis by biopsy-proven pathology. Clinicians should be aware of this pattern of granulomatous anterior uveitis probably indicating ocular sarcoidosis in a young individual.

Conflict of Interest

The authors have no proprietary or commercial interests in any concept or product discussed in this article.

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FIGURE AND FIGURE LEGEND

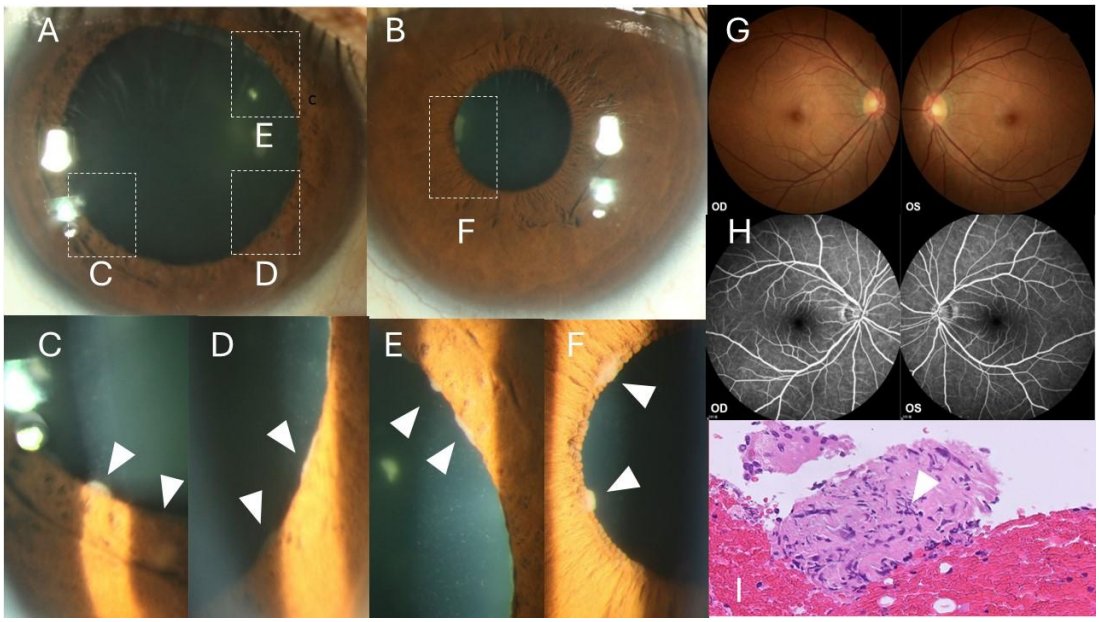

Figure 1. Ocular sarcoidosis with isolated anterior uveitis presenting Koeppe's nodules in both eyes by slit-lamp biomicroscope (Figure 1A,1B). Several whitish nodules appeared in the different sectors of pupil margins (Figure 1C-E, arrows) in the right eye, and three nasal pupillary nodules were observed in the left eye (Figure 1F, arrows). Bilateral unremarkable fundi findings by color fundoscopy (Figure 1G) and fluorescein angiography (Figure 1H). Histologic findings showed lymphoid tissue with non-necrotizing granulomas characterized by aggregates of epithelioid histiocytes and multinucleated giant cells (Figure 1I, arrows).

Biopsy-Proven Ocular Sarcoidosis Appearing Isolated Anterior Uveitis in a Young Woman

年輕女性罹患單純前葡萄膜炎經由切片診斷為眼類肉瘤症

彭繼賢 [1,2,] 陳怡伶 [2,3,*]

中文摘要

本文宗旨：報告一位年輕女性呈現兩側眼內前房 Koeppe 結節，後房沒有影響。經由切片病理診斷為確定的眼類肉瘤症。**方法：**回顧性病例報告。**結果：**38 歲女性因為全身無力合併輕微胸痛被送入急診室，評估後並無感染或心臟疾病，經由支持療法舒緩。一周後病患開始雙眼視力模糊，最佳矯正視力為雙眼 6/30，檢查發現兩側眼內呈現特殊的前房 Koeppe 結節，後房沒有影響。使用三到四周局部和口服類固醇藥物後，眼睛視力逐漸好轉到雙眼 6/6.7，雙眼前房無發炎，經由淋巴結切片呈現典型病理結果診斷為眼類肉瘤症。**結論：**眼類肉瘤症以單純呈現前房葡萄膜炎是不容易診斷的，並且要經由病理切片證實就更少了。年輕女性兩側眼內呈現特殊的前房 Koeppe 結節，在臨床上必須瞭解為包括眼類肉瘤症的肉芽性前葡萄膜炎症，並正確診斷治療。

關鍵字：眼類肉瘤症、前葡萄膜炎、病理切片

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Case Report

Endoscopic-assisted of transanal recto-anal anastomosis for the treatment of rectal Atresia: A Case Report

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ABSTRACT

Rectal atresia is a rare subtype of anorectal malformations in which the patients are born with a normal anal canal but have complete atresia located few centimeters proximal to the dentate line. We present one case using endoscopic-assisted the transanal recto-anal anastomosis as a new surgical technique for the management of rectal atresia. A male born with rectal atresia was diagnosed during physical examination and confirmed with X-ray. The anatomic appearance of the external anus, and perineum were normal. An X-ray of the abdomen showed a blind ending dilated intestine, 2.76 cm from rectum. A colostomy was performed. At the age of 6 months, a operation was carried out by using endoscopic assisted transanal recto-anal anastomosis surgical technique. Two weeks later, the colostomy was closed. The rectal anastomosis was treated with rectal dilatation daily in order to avoid stricture. In conclusion, the endoscopic assisted and transanal approach is an alternative to other surgical techniques in the management of rectal atresia.

Keywords: Anorectal malformation, Rectal stenosis, Rectal atresia, Posterior sagittal anorectoplasty

INTRODUCTION

Rectal atresia is an extremely rare anorectal anomaly malformation combining a normally developed anus and an atretic rectal segment representing 1-2% of all anorectal anomalies. Rectal atresia is considered separate from imperforate anus or anal atresia because, in rectal atresia, the anus is present and normal, but a variable rectal segment is atretic. Incomplete rectal atresia refers to complete membrane or severe stenosis. An in utero ischemic accident seems to explain the pathogenesis of this rectal malformation.[1,2]

We describe a case of rectal atresia in a male newborn presenting with an abdominal distension and failure of passing meconium. This aim of this paper is to present an operation technique of endoscopic assisted and transanal approach in rectal atresia.

CASE REPORT

A 2-day-old, full-term, 3.5-kg male baby, born after an uneventful normal spontaneous vaginal delivery, he was transferred to the neonatal intensive care unit (NICU) because of abdominal distension and failure to pass meconium. On rectal examination, the genital organs and external anus were normal (Figure 1). A thermometer was inserted into the anus, but it was ended at 2-3 cm from the anal verge. There was no meconium coated on the thermometer or in the urine. Abdominal X-ray showed dilated intestine with a blind distal end about 2.7 cm from rectum (Figure 2). The neonate was diagnosed as a rectal atresia and a sigmoid divided colostomy was performed. Postoperatively the distal segment of the colostomy was cleaned by using normal saline from the distal stoma opening once every week in order to avoid fecal accumulation and rectal distention. Follow-up distal colonography was performed at age of 5 months confirmed the continuity of the distal colon without stricture (Figure 3). At 6 months old, pediatric gastroenterologist performed a video endoscope through distal colostomy opening to the blind end of rectum, then it was pushed to the anus and recto-anal anastomosis was done with resorbable suture material (figure 4,5). There was no postoperative complication. He had normal defecation without soiling after the operation and the colostomy was closed 2 weeks later. Hegar dilator was used to prevent anastomosis stricture till the size of 16.

DISCUSSION

Rectal atresia with a normal anus is a rare anomaly mostly described as part of a series of anorectal malformation. Most authors believe it to be an acquired lesion with a vascular genesis.

Rectal atresia has been classified five type using the Ladd-Gross classification, Type I: rectal stenosis: (A) intramural, (B) web with a hole; Type II: rectal atresia with a septal defect; Type III: rectal atresia with a fibrous cord between two atretic ends; Type IV: rectal atresia with a gap; Type V: multiple: (A) rectal atresia with stenosis, (B) multiple rectal atresia, and (C) thickened Houstons valves/multiple rectal stenosis.[2]

Rectal atresia presents in the newborn period with a history of failure to pass meconium, progressive abdominal distention, refusal to feed and vomiting suggest the intestinal obstruction in neonates and lead to further investigations.[3]

Physical examination reveals marked abdominal distension with a normal anus and genital organs. The clinical diagnosis is easily confirmed with rectal thermometer, finger, or a red rubber catheter inserted and ended at 2-3 cm from the anal verge. Associated anomalies, although rare, may be sacral, cardiac, or renal anomalies.[4,5]

When a rectal atresia is clinically suspected, with the aid of abdominal radiograph and barium enema, the diagnosis can be established with dilated bowel loops with an absence of rectal gas of distal pouch and the atretic anal segment. In addition, ultrasonography and magnetic resonance imaging can be used to rule out pelvic floor, renal and spinal abnormalities.[6, 7]

The most common procedure performed for rectal atresia is a posterior sagittal anorectoplasty (PSARP) following an initial diverting colostomy. This technique is widely used due to its reported success in establishing fecal continence with reduced complications . However, PSARP involves extensive mobilization can injury the sphincter mechanism and the sensation inherent in it.

We present a case to illustrate the endoscopic-assisted transanal pull through recto-anal anastomosis technique for rectal atresia in our center. It shortened the operation time and reduced possibility of the injury to nearby anatomical structures. This technique is safe because better of visualization of the rectal pouch. Using video-endoscope is good tool to view the exact rectal pouch and working space, lowering the risk of injury to nerves or other pelvic organs during the operation. If the distance between the proximal and distal rectal ends is a long gap and it should be concerned that the urethra would be pushed down and injured. After the operation, the low rectal anastomosis should be dilated to prevent stricture. By using endoscopic assisted with the presence of diverting colostomy, this procedure is a good choice for avoiding 3-stage procedures in neonate with rectal atresia.

CONCLUSION

Using the combination of endoscopy and transanal approach is good alternative technique of management of rectal atresia's disease in children. This technique is safe, easy, lower risk of complications.

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FIGURE AND FIGURE LEGENDS

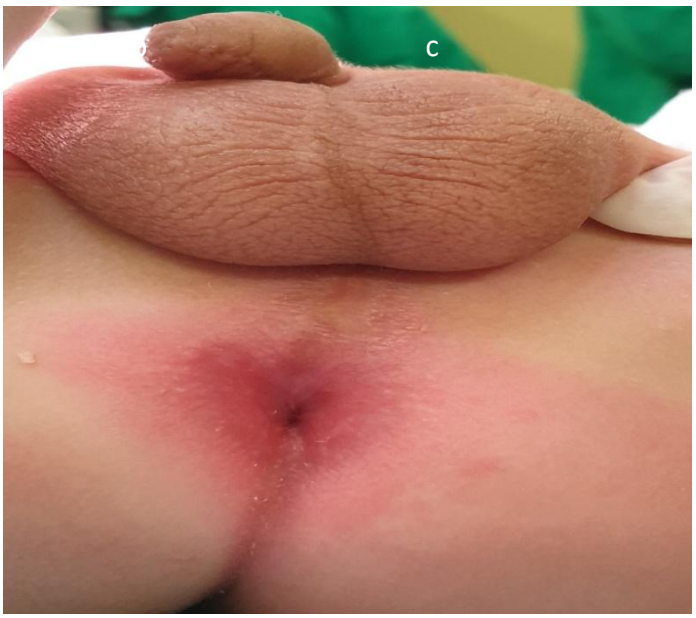

Figure 1. Normal genital organs and external anus

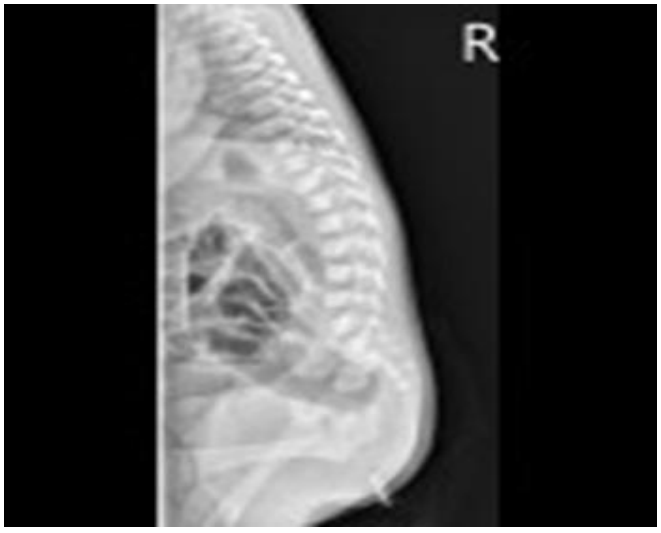

Figure 2. Abdominal X- ray showed a catheter is placed at the opening of the anus (arrow) and absent of rectal air at 1 day old.

Figure 3. A colonography showed the blind end rectum with a distance of 2.7cm (red line) to the external anus (arrow).

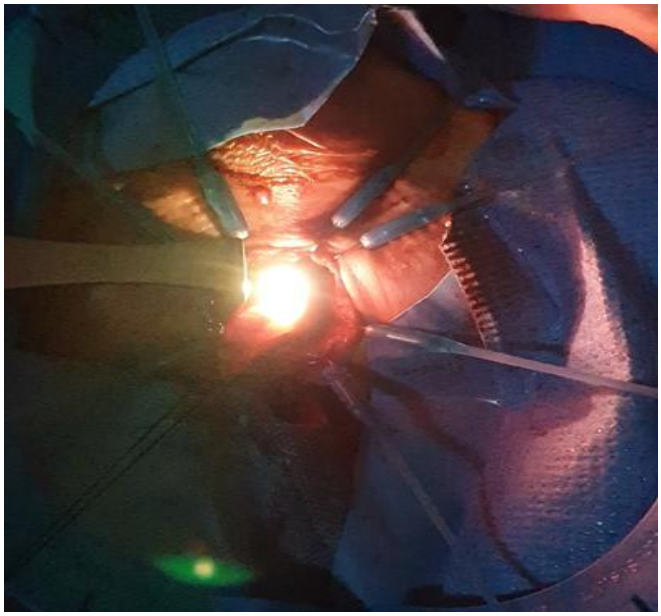

Figure 4. The endoscope was pushed down to the anus and it was seen at 1 cm from the anus.

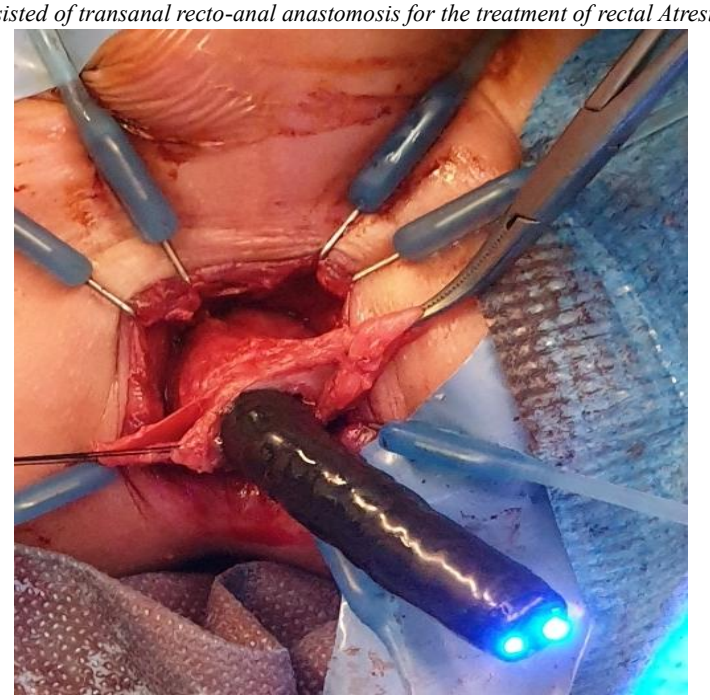

Figure 5. Figure 4. The endoscope was pushed down to the anus and it was seen at 1 cm from the anus.

內視鏡輔助經肛門直腸肛門吻合術治療直腸閉鎖：一病例報告

劉明發[1]　張繼仁[2,*]

中文摘要

直腸閉鎖是肛門直腸畸形的一種罕見亞型，患者出生時肛門外觀正常，但在直腸齒狀線近端距離 2-3 厘米處是完全的閉鎖。我們介紹一例使用內視鏡輔助的經肛門端對端直腸吻合術作為治療直腸閉鎖的新手術技術。一位男性新生兒出生時經身體檢查及 X 光檢查，診斷為直腸閉鎖。並且換患者先接受暫時性大腸造口術。在 6 個月大時接受利用內視鏡輔助經由肛門的方法來實施直腸重建術。手術兩週之後再實施大腸造口關閉及直腸吻合處手術。術後每天進行直腸擴張以避免狹窄達到最好的治療方式及預後。

結論，利用內視鏡輔助經肛門來治療肛門閉鎖是可以考慮手術的方式之一。

關鍵字：肛門直腸畸形、直腸狹窄、直腸閉鎖、後矢狀直腸成形術

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Case Report

Strategies for Managing Carotid Cavernous Fistulas Before and After Pipeline Embolization of Large Cavernous Aneurysms: A Review of Consecutive Cases

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ABSTRACT

This case report discusses management strategies for carotid cavernous fistulas (CCFs) before and after Pipeline embolization of large cavernous aneurysms. Two cases are presented: the first case is a 71-year-old woman with a right cavernous carotid aneurysm (CCA) resulting in a direct CCF. She was treated with transarterial coiling and Pipeline Embolization Device (PED) placement. The second case is a 62-year-old woman with a left CCA developing a direct CCF post-PED placement. She was treated with transvenous coil embolization. Both cases highlight different treatment strategies, demonstrating the efficacy of using PEDs in conjunction with coil embolization. The case report underscores the importance of tailored approaches based on individual patient anatomy and aneurysm characteristics, emphasizing the need for careful planning to mitigate complications including aneurysm rupture and CCF development.

Keywords: Cavernous Carotid Aneurysm, Carotid Cavernous Fistula, Pipeline embolization, Case Report, Transarterial Coil Embolization, Transarterial Embolization.

INTRODUCTION

Cavernous carotid aneurysm (CCA) typically carries a low risk of severe complications, but it can progress into large or giant aneurysms that that may rupture, or become thrombotic, leading to neurological deficits[1,2]. Endovascular embolization is a viable treatment option. However, traditional coil embolization shows only 40%-60% success[3,4]. On the other hand, balloon-assisted methods can improve success rates in certain cases, but they are associated with higher complication rates and do not significantly increase coil packing density[5].

The Pipeline Embolization Device (PED), a low-porosity cylindrical mesh that occludes aneurysms by diverting the flow of the parent artery, is a considered a safer and more effective treatment for large, wide-necked aneurysms, including cavernous and paraclinoid types [6,7,8,9]. However, the use of PED for direct carotid-cavernous fistulas (CCFs) is rare. In this study, we present these two

cases of direct CCFs treated with PED for CCAs and demonstrate the difference between treatment strategies using transarterial and transvenous coil embolization.

CASE REPORT

Case 1

Clinical Presentation

A 71-year-old woman presented with a one-year history of diplopia, and physical examination revealed right oculomotor nerve palsy. Brain MRI, using T2-weighted imaging, demonstrated a 2 cm right CCA (Figure 1A). Three-dimensional reconstructive digital subtraction angiography (DSA) identified a large saccular, narrow-necked aneurysm in the ventral cavernous segment of the right internal carotid artery (ICA), projecting inferiorly with significant mass effect, causing ICA compression. Additionally, a wide-necked saccular aneurysm (4 x 3 mm) was observed on the anterior wall of the M1 segment of the right middle cerebral artery (MCA) that projected inferomedially (Figure 1B, C). During the procedure, right ICA DSA revealed a rupture of the right CCA, resulting in a direct CCF (Figure 1D, E).

Treatment

We treated the CCF and underlying right CCA using transarterial coiling in conjunction with Pipeline Embolization Device (PED) placement. Bilateral femoral arterial access was achieved using a 6-French Shuttle (Cook, Bloomington, IN, USA) and 6-French Neuron (Penumbra, Darlinghurst NSW, Australia) tri-axial guide catheter, which was introduced into the right ICA via the right femoral artery. Simultaneously, a 5-French Envoy catheter (Codman & Shurtleff, Inc., Raynham, MA, USA) was navigated to the right ICA to provide control DSA. We inserted an SL-10 microcatheter (Stryker, Fremont, CA, USA) through the 5-French catheter and jailed it with a 4 mm x 20 mm PED, deployed from the Markman (Medtronic, Minneapolis, Minnesota) microcatheter (Figure 3A, B). After deploying 28 coils, the aneurysm was embolized using Axium (Medtronic, Minneapolis, Minnesota) detachable coils through the SL-10 microcatheter. The control DSA confirmed complete obliteration of both the aneurysm and the CCF (Figure 3C, D). Next, The SL-10 microcatheter was advanced to the right M1 segment aneurysm, while another Prowler Select Plus microcatheter (Codman & Shurtleff, Inc. Raynham, MA, USA) was positioned in the right M1 segment, prepared for 4.5 x 22mm Enterprise intracranial stent (Codman & Shurtleff, Inc. Raynham, MA, USA). After deploying five coils, the aneurysm was successfully embolized (Figure 3E).

Case 2

Clinical Presentation:

A 62-year-old woman presented with a 3-month history of double vision and intermittent left eye pain. Physical examination revealed left eye ptosis. Brain MR angiography demonstrated a 2 cm left CCA (Figure 2A), and DSA revealed a wide-necked aneurysm at the left ICA (Figure 2B, C). Under general anesthesia, a 5 mm x 20 mm PED was deployed across the aneurysm ostium (Figure 2D, E). Follow-up DSA showed significant contrast stasis, indicating successful flow diversion (Figure 2F). The patient recovered without neurological complications, and her diplopia improved. One month later, she developed recurrent ptosis and headache. Steroid therapy was initiated for a suspected mass effect, but a bruit developed 2 months later. Repeat DSA revealed a direct CCF with opacification of the cavernous sinus and bilateral inferior petrosal sinuses (Figure 2G, H).

Treatment:

A transarterial approach through the fistulous site was not feasible because the low porosity of the PED prevents transarterial access into the aneurysm, rupture site, or fistulous connection. The patient underwent transvenous coil embolization for treating the CCF caused by a rupture of a left CCA. The left internal jugular vein was accessed with a 5-French sheath. A 5-French H1 guide catheter was coaxially introduced into the left inferior petrosal sinus (IPS) and a SL-10 microcatheter was navigated to the left cavernous sinus through the catheter in the left IPS. A 6-French guide catheter (Envoy) was introduced in the left ICA to control the DSA from the right femoral artery (Figure 4A, B). Due to the small orifice of the fistula between the aneurysm and the cavernous sinus, detachable coils were deployed directly into the cavernous sinus. (Figure 4C, D). As shown in Figure E and F, after deploying 23 Axium coils (Medtronic, Minneapolis, Minnesota), the flow through the fistula significantly decreased. Although a residual fistula was still present, we predicted that it would be spontaneously obliterated. In a follow-up DSA performed 3 months later, we observed a complete closure of the residual fistula (Figure 4 G, H).

Outcome and follow-up:

Both of these patients reported relief from diplopia after their procedures and no longer required the use of eye patches.

This study was approved by Institution-al Ethics Review Board (permission number: 20240719R)

DISCUSSION

Case 1 involved a direct CCF resulting from a ruptured CCA, treated with transarterial coiling and a PED. Traditional treatments for direct CCFs caused by ruptured CCAs include balloon occlusion and stent-assisted coiling[1,10,11], but these methods have limitations. Flow diverters (FD) have shown effectiveness, though they are rarely used[12,13]. FDs are also an effective treatment option for traumatic CCFs[12,14,15]. Low-flow, benign-type CCFs may close spontaneously, while those with venous drainage to the cortical veins require endovascular treatment to reduce the risk of intracranial hemorrhage. Transarterial coil embolization alone may not be sufficient, as it leaves the underlying vessel pathology untreated and may require unnecessary sacrifice of the parent artery. In cases of spontaneous rupture of a cavernous ICA aneurysm resulting in a direct CCF, combining FD deployment with transarterial coil embolization is effective in occluding both the CCF and the aneurysm.

Case 2 involved a direct CCF resulting from a delayed ruptured CCA after PED placement. The PED blocked the arterial route, necessitating a transvenous approach to preserve the parent artery. The cavernous sinus was accessed via the IPS, superior ophthalmic vein, facial vein, or through direct puncture. Once the cavernous sinus was reached, coil embolization was initiated at the appropriate site. Our treatment strategy focuses on occluding cortical drainage and addressing dangerous anastomoses. Complete occlusion of all fistulas is not always necessary, as slow-flow, benign-type fistulas may close spontaneously. Super-selective embolization of the fistula connection or the aneurysmal sac is sometimes difficult and time-consuming. We demonstrate an alternative treatment strategy compared to the previous two cases, with favorable outcomes[11].

CONCLUSION

Spontaneous CCF can occur in large cavernous ICA aneurysms, even when treated with FD alone. Coiling in conjunction with PED placement can help reduce the risk of complications associated with CCFs resulting from aneurysm rupture. Both transarterial and transvenous approaches offer higher occlusion rates for both the aneurysm and the concomitant CCF.

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FIGURE AND FIGURE LEGENDS

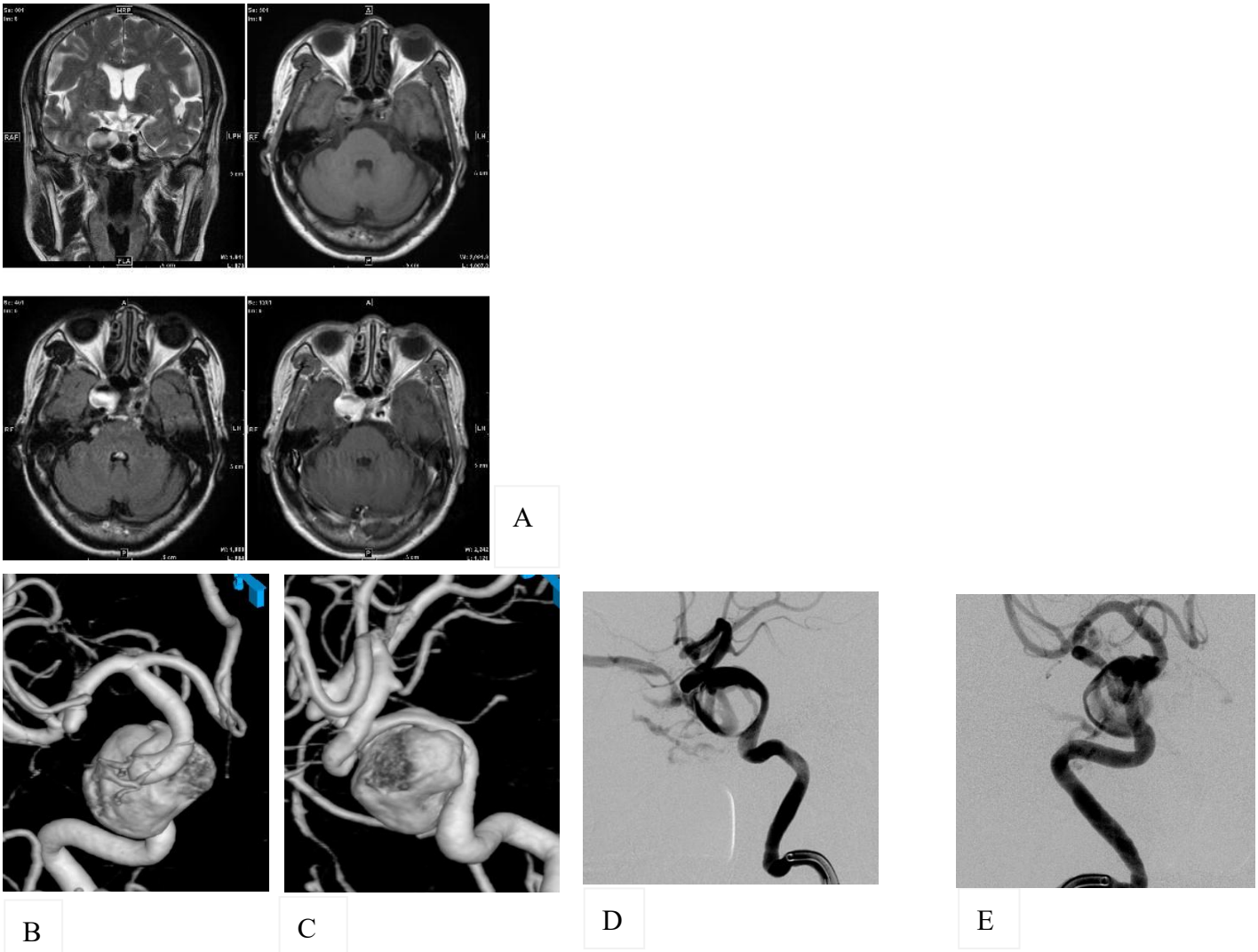
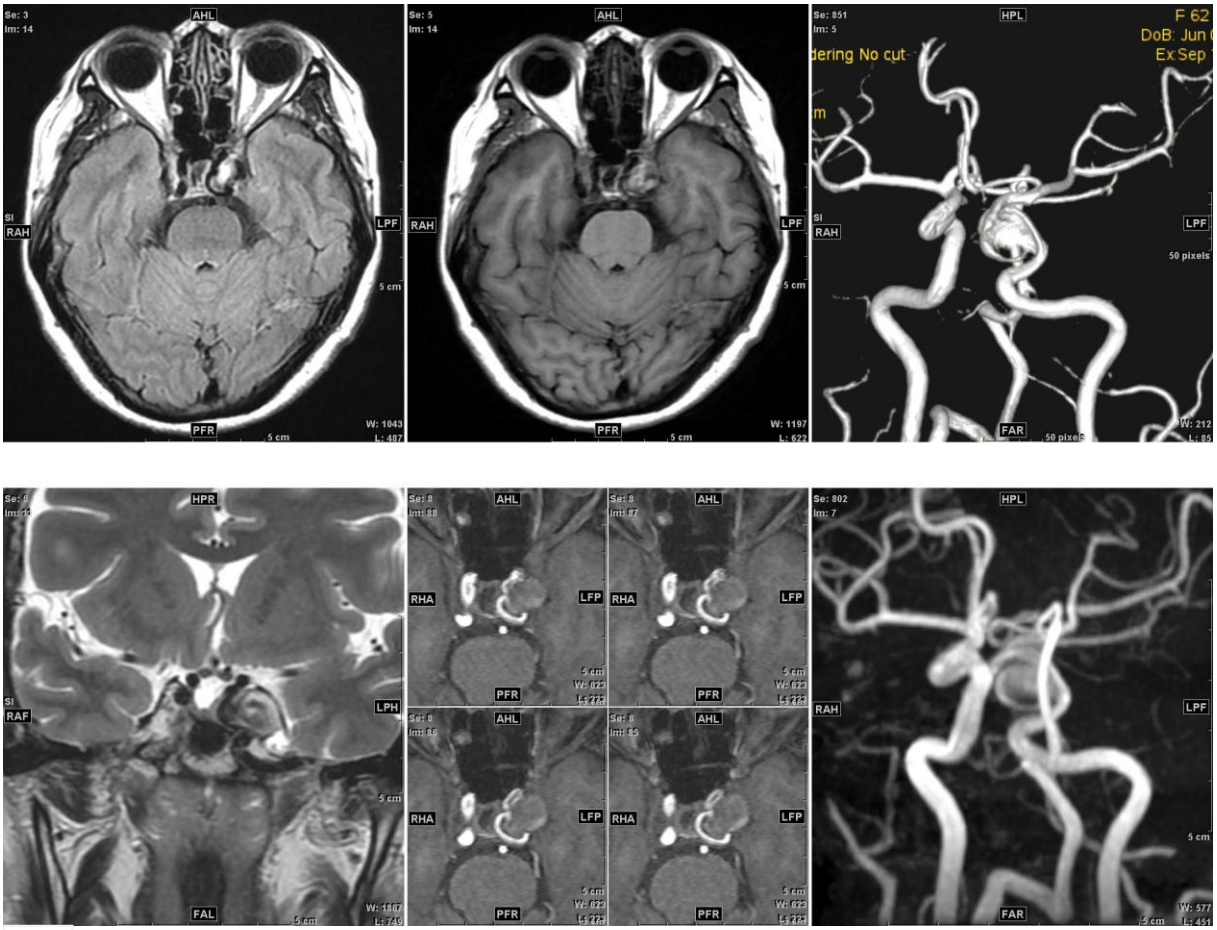


Figure 1. Case 1- Right cavernous carotid aneurysm (RCCA) before PED placement and direct CCF resulting from RCCA rupture.

(A) T2-weighted imaging showing a large RCCA measuring approximately 2cm.

(B, C) Reconstructive 3-dimensional DSA of right ICA (B: anteroposterior view, C: lateral view) showing a large saccular narrowed-necked aneurysm arising from the ventral cavernous ICA with ICA compression, and another wide-necked saccular aneurysm on the anterior wall of right M1 segment.

(D, E) DSA of right ICA (D: anteroposterior view, E: lateral view) demonstrating a direct CCF caused by the rupture of RCCA.



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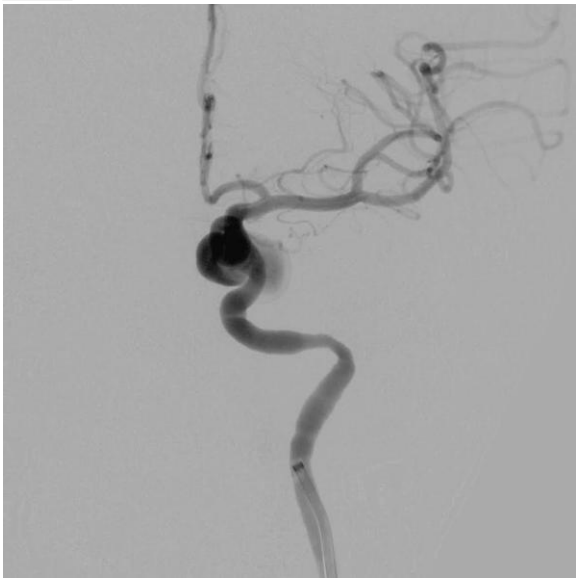

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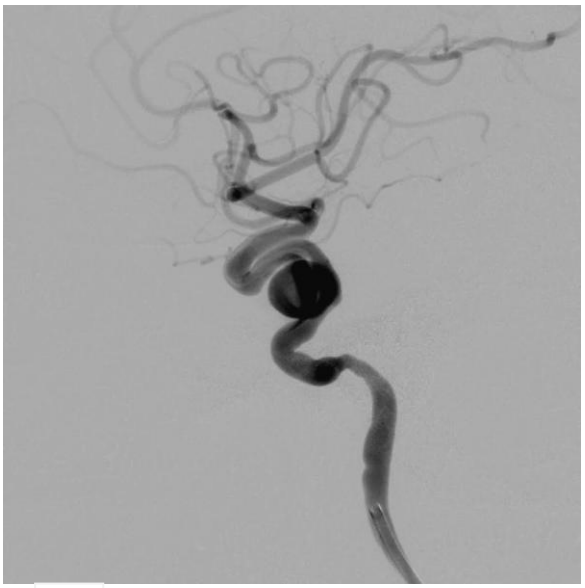

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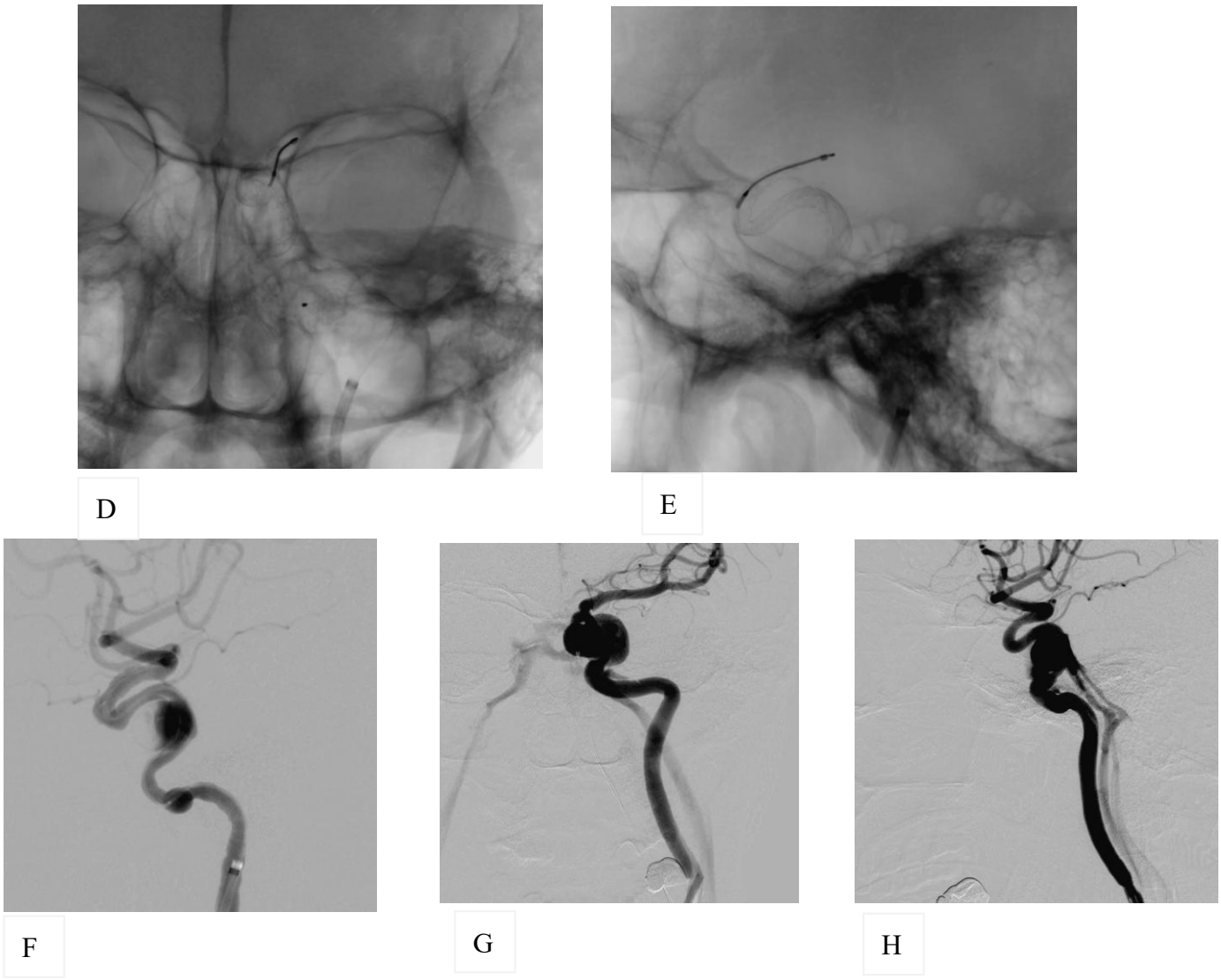


Figure 2: Case 2- Left cavernous carotid aneurysm (LCCA) after PED placement and direct CCF occurring 2 months post-treatment.

(A) Brain MR angiography showing a large LCCA measuring approximately 2cm. (B, C) DSA of left internal carotid artery (ICA) (B: anteroposterior view; C: lateral view) demonstrating a large, wide-necked aneurysm at the lateral segment of left ICA. (D, E) Post-PED fluoroscopy images (D: anteroposterior view; E: lateral view) showing a 5mm x 20mm PED successfully deployed across the aneurysm ostium. (F) Follow-up DSA images showing significant contrast stasis within the aneurysm. (G, H) Follow-up DSA of left ICA 2 months later, showing a direct CCF with opacification of cavernous sinus and bilateral IPS.

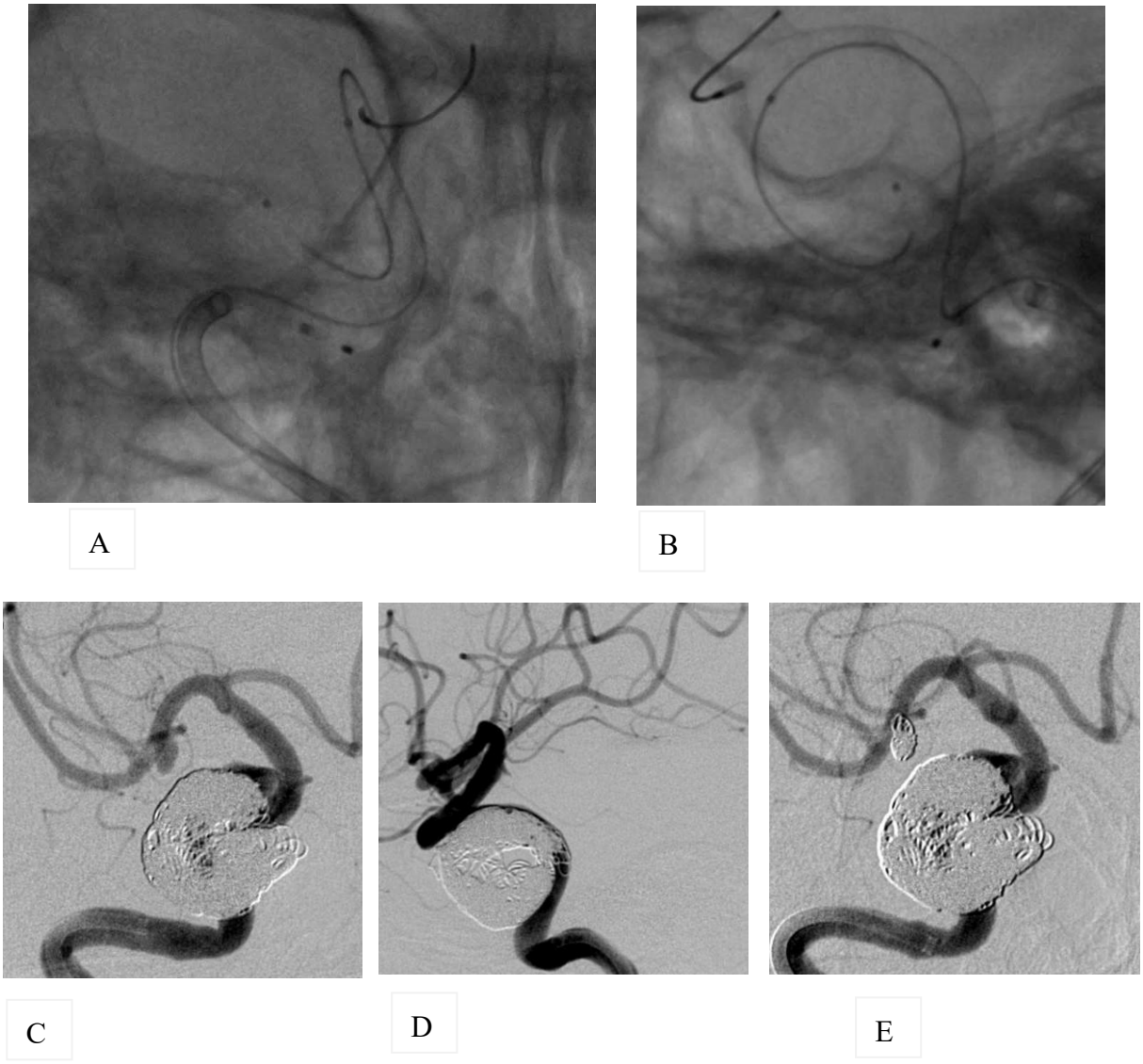
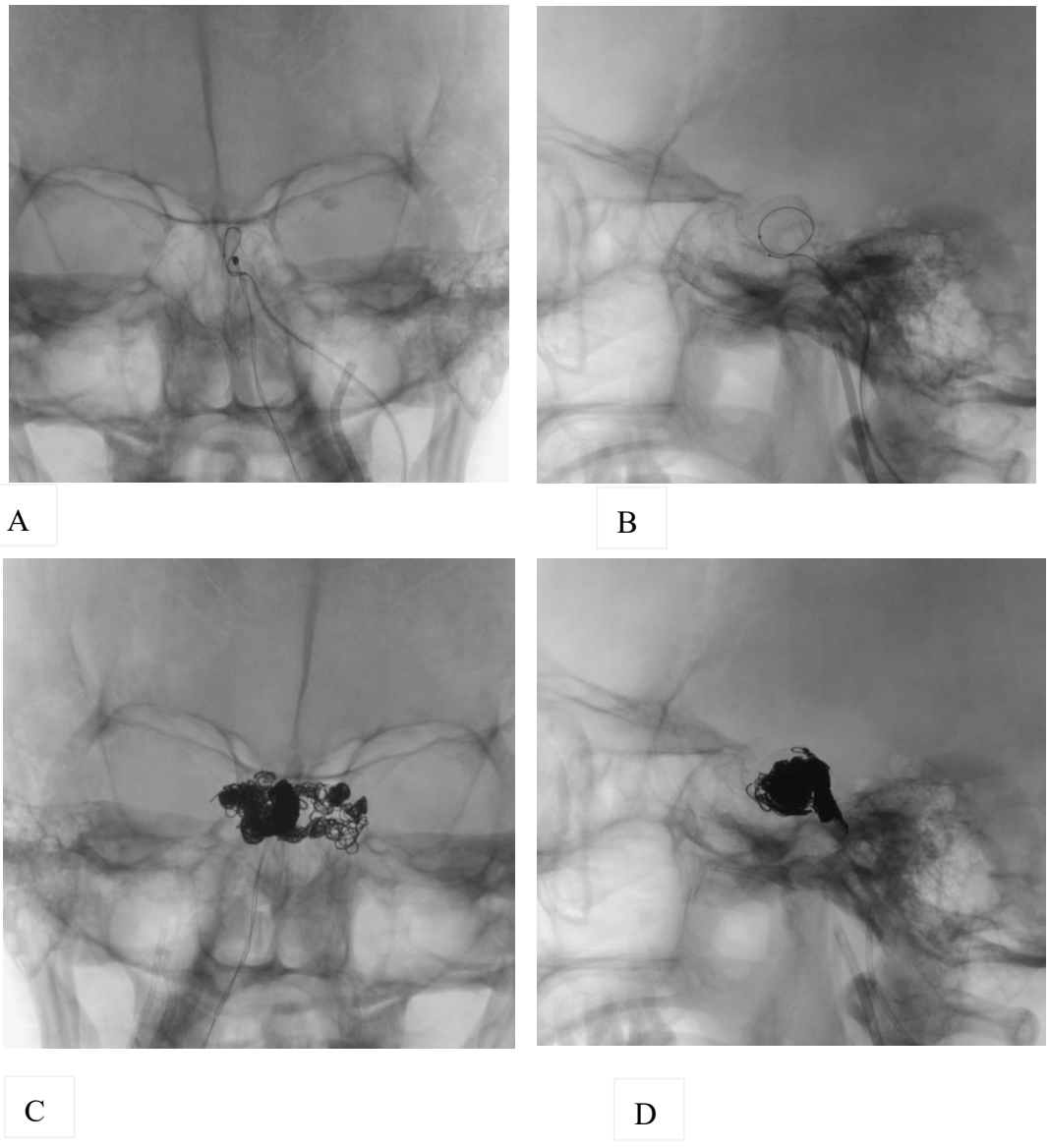


Figure 3. Transarterial coil embolization of Case 1 - RCCA and direct CCF (A, B) Native fluoroscopy images (A: anteroposterior view; B: lateral view) showing the tip of SL10 microcatheter within the aneurysmal sac, jailed with a 4mm x 20mm PED. (C, D) DSA of right ICA (C: anteroposterior view; D: lateral view) demonstrating complete occlusion of the aneurysm and the CCF after the deployment of 28 coils through the SL10 microcatheter. (E) DSA of right ICA showing embolization of another aneurysm at right M1 segment after the deployment of 5 coils and stenting with a 4.5mm x 22mm Enterprise stent.



A B C D

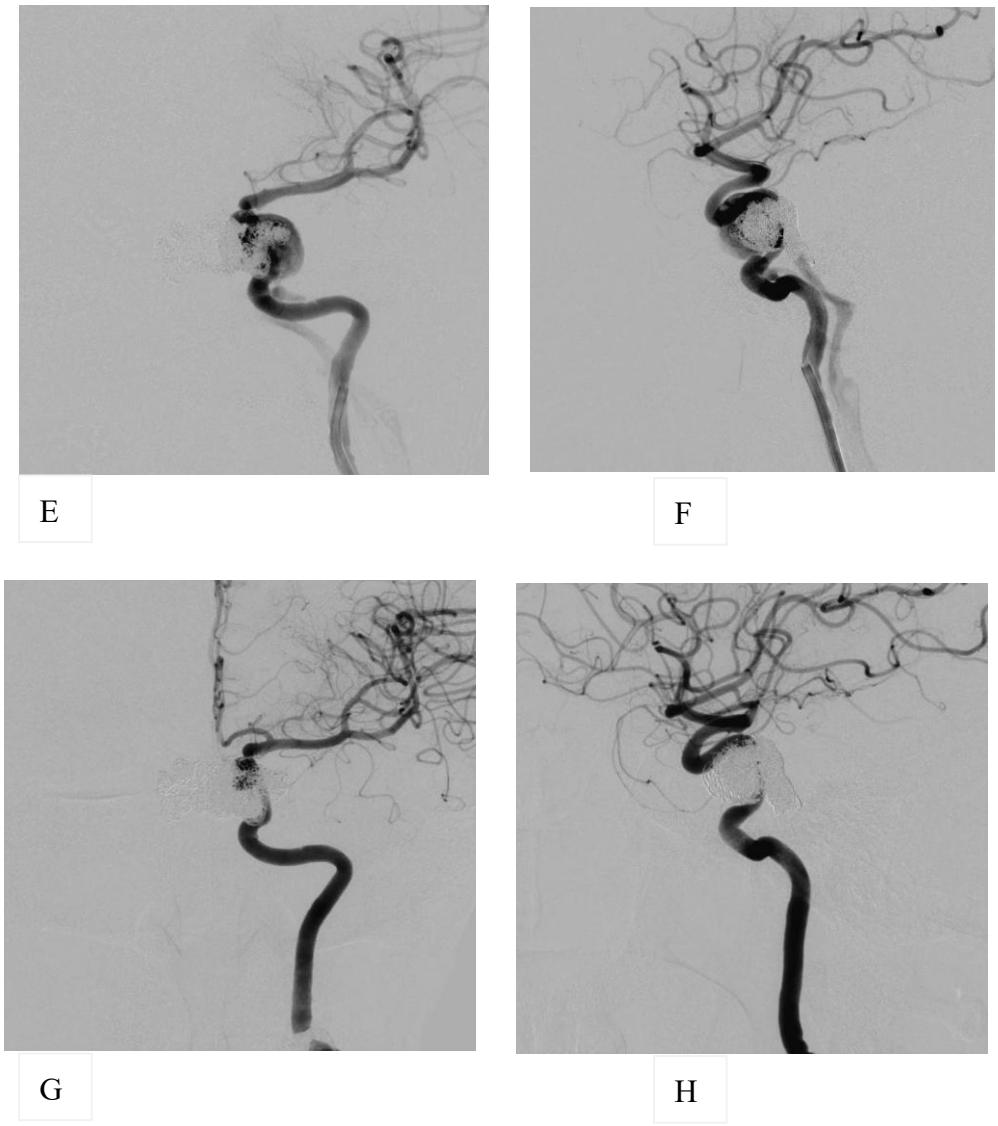


Figure 4. Transvenous coil embolization of Case 2 -Direct CCF following PED placement. (A, B) Native fluoroscopy images (A: anteroposterior view; B: lateral view) showing the tip of SL10 microcatheter in cavernous sinus via the left inferior petrous sinus. (C, D) Native fluoroscopy images (C: anteroposterior view; D: lateral view) showing the deployment of 23 coils predominantly in the left cavernous sinus. (E, F) DSA of left ICA (E: anteroposterior view; F: lateral view) demonstrating a significant decrease in the flow through the fistula after embolization, with absence of filling in the right cavernous sinus and right IPS. (G, H) Follow-up DSA of the left ICA at 3 months (G: anteroposterior view; H: lateral view) showing complete closure of the residual fistula.

Strategies for Managing Carotid Cavernous Fistulas Before and After Pipeline Embolization of Large Cavernous Aneurysms: A Review of Consecutive Cases

大型海綿竇動脈瘤管道栓塞術之處置方法：病例回顧

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中文摘要

本病例報告討論了在大型海綿竇動脈瘤管道栓塞（PED）前後管理頸動脈海綿竇瘺（CCFs）的策略。報告了兩個病例：病例報告強調了根據個體患者解剖結構和動脈瘤特徵量身定制治療方案的重要性，並強調需要仔細規劃以減輕動脈瘤破裂和 CCF 發展的併發症。海綿竇頸動脈瘤（CCA）雖然通常具有較低的嚴重併發症風險，但仍可能導致大型或巨大動脈瘤破裂或血栓性動脈瘤，進而引發神經功能缺損。傳統的線圈栓塞術僅有 40%-60%的成功率，儘管球囊輔助方法可以提高成功率，但也會增加併發症風險且不會增加線圈填充密度。管道栓塞裝置（PED）是一種更安全且更有效的治療方法。然而，PED 用於直接頸動脈海綿竇瘺（CCF）的情況較少見。本研究報告了兩例 PED 治療 CCA 前後的直接 CCF 病例，並比較了經動脈和經靜脈線圈栓塞的治療策略差異。第一個病例是一名 71 歲的女性，患有右側海綿竇頸動脈瘤（CCA），導致直接 CCF，採用經動脈線圈栓塞和管道栓塞裝置（PED）進行治療。第二個病例是一名 62 歲的女性，左側 CCA 在 PED 置入後出現 CCF，以經靜脈線圈栓塞進行治療。本篇透過比較此二病例治療策略，強調了管道栓塞裝置在治療頸動脈海綿竇瘺中的應用及其效果。

關鍵字：海綿竇頸動脈瘤、頸動脈海綿竇瘺、管道栓塞、病例報告、經動脈線圈栓塞、經動脈栓塞

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The Fu-Jen Journal of Medicine (FJJM) is a peer-reviewed journal which aims to enhance research quality of staffs in the College of Medicine, Fu Jen Catholic University. The journal publishes original investigations across a wide range of medical disciplines including original research articles in basic and clinical sciences, case reports, review articles, brief reports, and letter to the editor. FJJM is now issued by the Center of Medical Education in the College of Medicine, Fu Jen Catholic University. To promote journal quality, the manuscript submitted to FJJM after August first 2015 has to be prepared in English to meet the international standards.

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