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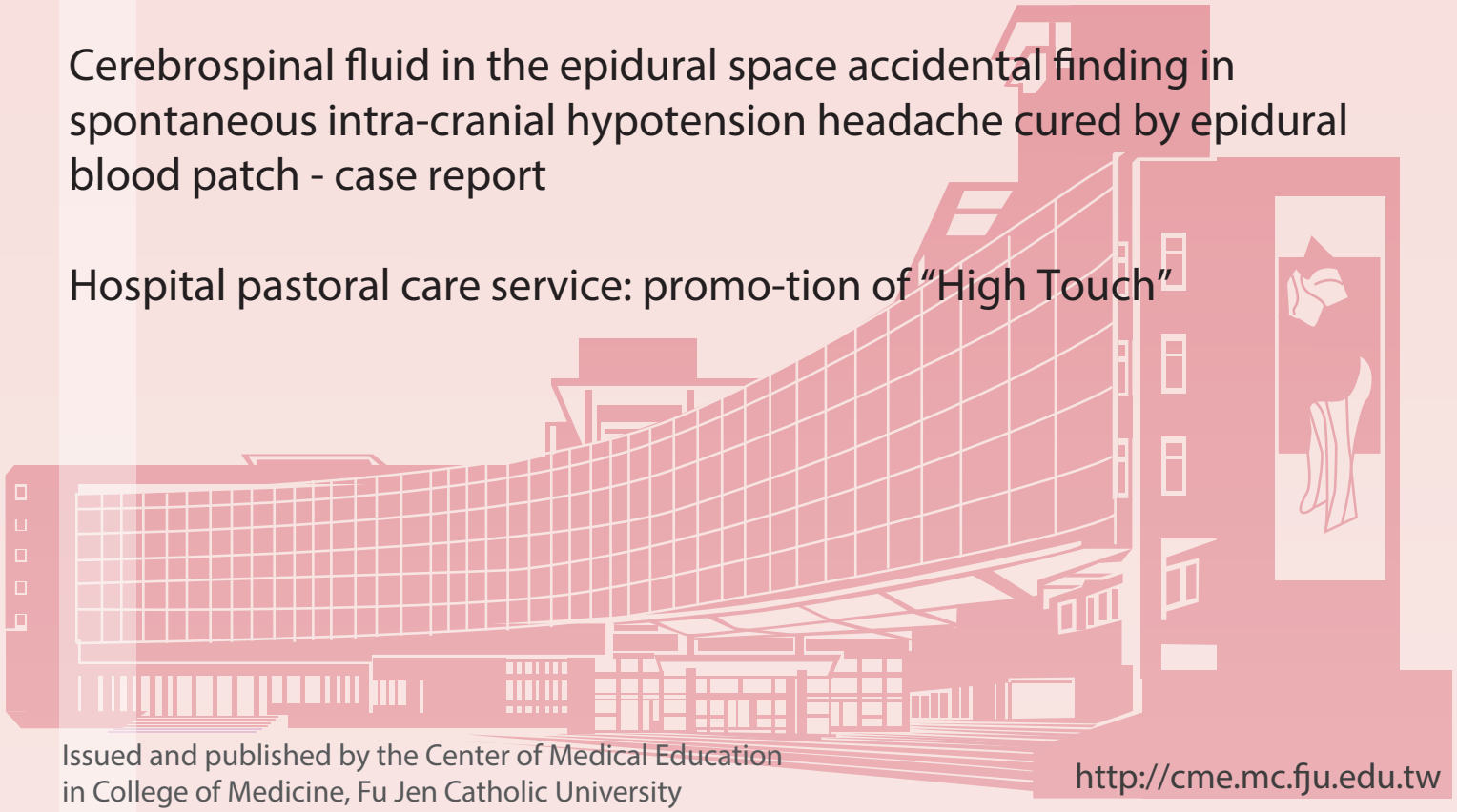

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Original Research Article

Emotion sensitivity and negative affect in borderline personality disorder: role of emotion regulation

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ABSTRACT

Objective: Borderline personality disorder (BPD) is characterized by negative affect, including hostility, jitters, distress, guilt, and scared. The present study proposed that emotion sensitivity and emotional dysregulation predict negative affect in patients with BPD, and that emotional dysregulation mediates the relationship between emotion sensitivity and negative affect. ***Method:*** Participants 31 BPD patients include 26 female and 5 male, with average age of 33.35 years old. All participants completed the Borderline Personality Inventory, the Emotion Evaluation Subtest, Positive and Negative Affect Schedule, and Difficulties in Emotion Regulation Scale. ***Results:*** Mediation analysis indicated that limited access to emotion regulation strategies mediated the relationship between anxiety sensitivity and overall negative affect, impulse control difficulties mediated the relationship between anxiety sensitivity and jitters, and non-acceptance of emotional responses mediated the relationship between aversion sensitivity and guilt. ***Conclusions:*** This has significant treatment implications, highlighting that learning skills in managing and regulating emotions, accepting one's emotions, and avoiding self-destructive impulse behavior should be targets of intervention. Another implication of this finding is the importance of providing intervention to reduce emotion sensitivity in social interactions.

Keywords: borderline personality disorder, emotion sensitivity, negative affect, emotion regulation

INTRODUCTION

Patients with borderline personality disorder (BPD) exhibit relatively poor emotion identification compared with healthy people, particularly for negative emotions such as anger, fear, sadness, and averseness[1,2]. According to the Biosocial Developmental Model, overly high emotional sensitivity is a risk factor of early BPD, and patients with BPD may develop a transactional vicious cycle with their environment during the process of development[3]. This phenomenon suggests that emotionally sensitive children and their primary caregiver mutually influence each other; this influence negatively reinforces the behaviors of these children, consequently creating an invalidating emotional environment where BPD patients continue to exhibit an overly high degree of emotional sensitivity during development. When a person faces excessive long-term emotional sensitivity, s/he tends to be alert and overreact to emotions, further developing emotional vulnerability[3]. Previous studies on emotional sensitivity have mostly adopted pictures of facial affect as experimental stimuli, using computerized morphing technology to gradually transform neutral images into images expressing a target emotion. Patients with BPD typically perform poorly in terms of reaction time to accurately identify a target emotion[4,5,6].

Affect refers to a type of sensory experience induced by internal or external stimuli that manifests as a physiological reaction or movement. Affect influences people's thoughts of and reactions to themselves and others including how they respond to environmental stressors and interpersonal relationships[7]. Watson and colleague considered that both positive and negative affect have evolutionary implications[8], where negative affect is part of a withdrawal-oriented behavioral inhibition system that prompts people to avoid problems by inhibiting behaviors that can cause pain, punishment, or other negative outcomes. Among all types of negative affect found in patients in BPD, hostility and anger are the first two types that draw the attention of psychologists. Various behaviors exhibited by patients with BPD in interviews tend to be explained as (conscious or unconscious) actualization of anger or hostility. However, behaviors that manifest as anger can be derived from other types of negative affect such as sadness, shame, guilt, fear, and anxiety. Previous studies also claimed that anger and hostility are often the eventual manifestation of other internal negative feelings[9,10,11]. Misinterpreting the behavior of patients with BPD as hostile or aggressive may trigger real anger in the patients[3]. Recent affective studies on BPD have typically focused on secondary emotions. In other words, when patients with BPD experience negative emotions, they develop a sense of guilt, shame, or self-critical thoughts because they cannot accept their emotional reactions. Compared with primary emotions, which are more direct and closer to actual feelings, secondary emotions generally emerge when a person attempts to suppress or block his or her primary emotions, and they are more likely to be triggered in an invalidating emotional environment. Secondary emotions belong to a type of distorted cognitive process and are related to maladjustment and self-destructive behaviors[3]. Another emotional state commonly observed in patients with BPD is jitters, which include affective lability, lower self-esteem, and a propensity to feel anxious or frustrated. Studies have also found that higher levels of jitters are related to the chronic symptoms of BPD[12]. Although jitteriness is generally considered a personality trait, recent studies have found that individuals who are jittery are prone to being influenced by negative life events and chronic stress[13].

The process of emotional regulation includes (1) emotional awareness and understanding, (2) emotional acceptance, (3) control of impulsive behaviors and maintaining desired goals despite experiencing negative emotions, and (4) flexibly employing situationally appropriate emotional regulation strategies to modulate emotional responses to meet individual goals and situational demands[14]. Self-awareness and identification of emotions are essential in the process of emotional regulation. Before solving problems initiated by emotions, people should be able to discern their emotions. However, patients with BPD have difficulty discerning and identifying their feelings spontaneously. Instead, they require environmental cues to decide how to think, feel, or act. Lacking such ability also causes these patients to hold fluctuating views toward themselves and others, which can damage their social relationships[10,15]. Regarding this situation, Linehan considered that an invalidating environment prevents patients with BPD from experiencing emotion-related implications and motivations appropriately[3], which influences their ability to explain their emotions and related behaviors, causing further difficulty in describing their internal experiences[3,10]. Several studies have applied the concept of alexithymia to expound the difficulties that individuals encounter in describing their emotions, adopting an externalized model of emotion attribution. Studies have shown that alexithymia can predict the

severity of BPD, and it is related to internal negative feelings experienced by patients with BPD [16].

According to the Biosocial Developmental Model, an invalidating emotional environment leads patients with BPD to internalize the image of their caregivers, and particularly their invalidating emotions. Therefore, these patients tend to suppress or reject their emotional responses, thus producing a negative evaluation of their own feelings. However, long-term suppression is likely to generate adverse outcomes. Specifically, these individuals do not learn how to handle their emotions from their experiences or that emotional avoidance cannot solve the problems they face. In addition, suppressing their own emotional responses generates secondary emotions. The result approximates the process of avoidance conditioning, where individuals avoid the pain from their primary emotions by triggering secondary emotions. However, this process of negative reinforcement deprives individuals of the opportunity to face and handle their primary emotions, as well as the opportunity to build individual pain endurance based on experiences [3].

Another common characteristic of patients with BPD is difficulty controlling impulses such as suicidal or self-destructive behaviors, overeating, and alcohol or drug abuse. In the process of development, such impulsive behaviors are retained likely because they can temporarily solve overwhelming, uncontrollable, or extremely painful emotions[3]. Other studies have found that the impulsive behaviors of patients with BPD typically trigger the need for care or attention from others as a coping mechanism by gaining either assistance from others or temporary social support. Moreover, patients with BPD tend to pursue immediate rewards, exhibiting low levels of delayed gratification. Therefore, they tend to form biases in decision-making processes, adopting impulsive behaviors as a means for emotional regulation[17]. In summary, patients with BPD experience multiple difficulties in emotional regulation, including an inability to be aware of or understand their emotions, the rejection of their emotions, and impulsive reactions.

In line with a review of the literature, this study hypothesizes that (1) emotion sensitivity and emotional regulation will predict negative affect in patients with BPD. Negative affect includes irritability, distress, shame, upset, jitters, guilt, afraid, hostility, nervousness, and scared. (2) Difficulty with emotional regulation mediates the relationship between emotion sensitivity and negative affect. The present study adopted the constructs proposed by Gratz and Roemer[18] to gain a more comprehensive understanding of the difficulties in emotional regulation exhibited by patients with BPD.

PARTICIPANTS、MATERIALS AND METHODS

Participants

The study protocol was approved by the ethics committee of the Mackay Memorial Hospital. Informed and written consent was obtained from participants. Diagnosis of BPD was verified by a trained psychiatrist using structured interviews. Participants were included in the BPD group if they fulfilled at least five diagnostic criteria of BPD according to the DSM-5[19]. Exclusion criteria were alcohol intoxication during testing, head injury, schizophrenia, and age less than 18 or above 65 years. The BPD group included 34 participants. By ruling out participants under 20 years old (n = 1) and those who did not meet the diagnostic criteria of BPD (n = 2). There were 31 patients include 26 female and 5 male, with average age of 33.35 years old and 14.00 education years.

Instruments

Emotion sensitivity. The Awareness of Social Inference Test (TASIT) was used to assess the emotion sensitivity. Because it is presented in video form, it has strong ecological validity for assessing emotion sensitivity in daily life. The TASIT is designed for the clinical assessment of emotion identity[20]. We used the emotion evaluation subtest to assess the ability to recognize the six basic emotions: happiness, surprise, anger, sadness, anxiety, aversion, and neutral. In the film, the emotion is presented by monologue or dialogue between two characters (15–60 seconds). Participants were asked to identify the emotion of the protagonist after watching the film. This subtest of the TASIT has good reliability and validity, the test–retest reliability is .74 to .88[20]. The Chinese version of TASIT, revised by Liu, Tseng and Yeh (2018) also has good reliability and validity[21].

Difficulties in emotion regulation. The Difficulties in Emotion Regulation Scale (DERS)[18] identifies six common types of difficulty in emotional regulation, including rejection of emotional reactions (Non-acceptance), difficulty engaging in goal-oriented behaviors (Goals), difficulty controlling impulses (Impulse), lack of emotional awareness (Awareness), lack of emotional regulation strategies (Strategies), and lack of emotional specificity (Clarity). The

DERS is a self-report measure developed to assess clinically relevant difficulties in emotion regulation. This measure is composed of 36 items scored on a 5-point Likert scale, ranging from 1 (almost never [0–10%]) to 5 (almost always [91–100%]). The DERS has high internal consistency (Cronbach's α = .93), and the subscales also have adequate internal consistency (Cronbach's α > .80 for each subscale)[18]. The Chinese version of DERS, revised by Wen (2006) also has good reliability and validity (Cronbach's α= .80~ .92 for each subscale)[22].

Negative affect. The negative affect is assessed by The Positive and Negative Affect Schedule (PANAS) which was developed by Watson, Clark, and Tellegen[8]. Negative Affect is a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including irritability, distress, shame, upset, jitters, guilt, scared, hostility, nervousness, and afraid. Negative scales consist of 10 items scored on a 5-point Likert scale, ranging from 1 (very slightly or not at all) to 5 (very much). The subscales also have high internal consistency (positive affect, α = .86–.90, negative affect, α = .84–.87), and it has adequate construct validity[8]. The Chinese version of PANAS, revised by Teng and Chang (2008) also has good reliability and validity (Cronbach's α = .83–.91 for each subscale)[23].

Statistical Analysis

The correlation coefficients between variables were reported. Then, we conducted hierarchical regression analysis, with negative affect as the dependent variable (DV), and emotion sensitivity and emotional dysregulation as the independent variables (IVs). According to the results of hierarchical regression, a mediation analysis was conducted. Mediation was examined by testing the significance of the indirect effect of the IV on the DVs through the proposed mediator (M), calculated as the product of the effects of the IV on the M (a) and the M on the DV (b). A bootstrapping approach was used to estimate the indirect effect (a × b) based on a mean derived from 1000 samples with replacement[24]. Bias-corrected 99% confidence intervals (CIs) were calculated, with the indirect effect estimate interpreted as significant when the CI did not contain zero.

This study was approved by Institution-al Ethics Review Board (permission number: 14MMHIS085e)

RESULTS

Regarding the correlations between variables, negative affect not only had positive correlations with emotion sensitivity (including sad, anxiety, and aversion), but also positive correlations with emotional regulation difficulty (including non-acceptance, goals, impulse, and strategies). Table 2 shows the result of hierarchical regression analyses, where anxiety sensitivity had a significant predictive effect on negative affect (β = .52), explaining 24% of the variance in negative affect. The full model was significant (F(1, 28) = 10.30). In step 2, lower emotion regulation strategies had a significant predictive effect on negative affect (β = .55), and anxiety sensitivity still had a significant predictive effect on negative affect (β = .33). It explained 50% of the variance in negative affect, which was significant (F(1, 27) = 15.56) with a 27% increase in explanatory power.

More detailed hierarchical regression analyses were conducted for the irritability, distress, shame, upset, jitters, guilty, fear, hostility, nervousness, and afraid factors (Table 3). Total anxiety sensitivity, goals, and impulse of emotion dysregulation explained 38% of the variance in irritability (F(3, 26) = 7.01). Anxiety sensitivity and lack of strategies explained 48% of the variance in distress (F(2, 27) = 14.31) and 37% of the variance in scared (F(2, 27) = 9.53). Lack of strategies explained 30% of the variance in shame (F(1, 28) = 13.46). Both anxiety sensitivity and impulse explained 42% of the variance in upset (F(2, 27) = 11.45), 60% in jitters (F(2, 27) = 22.32), and 39% in nervousness (F(2, 27) = 10.23). Aversion sensitivity and non-acceptance explained 39% of the variance in guilty (F(2, 27) = 10.30). Aversion sensitivity and goal of emotion dysregulation explained 24% of the variance in afraid (F(2, 27) = 5.64). Anxiety sensitivity explained 11% of the variance in hostility (F(1, 28) = 4.62).

As the main purpose of this study was to test whether emotion dysregulation in BPD mediates the relation between emotion sensitivity and negative affect, a bootstrap test was used to exam the mediated pathway. As Table 4 shows, findings of a significant indirect effect (a × b) and a nonsignificant direct effect (c') indicate that emotion dysregulation fully mediated the association between emotion sensitivity and negative affect. The results show that (1) there was an indirect effect between anxiety sensitivity and the total scores of negative affect, where strategies of emotion dysregulation was a mediator in this pathway (c = 3.24); (2) there was an indirect effect between anxiety sensitivity and jittery, where impulse of emotion dysregulation was a mediator (c = .49); (3) there was an indirect effect between aversion sensitivity and guilty,

with non-acceptance of emotion dysregulation as a mediator (c = .28); and (4) there was an indirect effect between anxiety sensitivity and nervousness, where impulse of emotion dysregulation was a mediator (c = .42).

DISCUSSION

The purpose of this study was to understand the role of emotion dysregulation in the relation between emotion sensitivity and negative affect in BPD. To examine the mediated pathway, we first used hierarchical regression to select the most predictive variables. Second, we used a bootstrap measure to exam the mediation effect. The results indicated an indirect effect between anxiety sensitivity and negative affect. Strategies of emotion dysregulation mediated this pathway. Regarding different types of negative affect, anxiety sensitivity indirectly predicted nervousness and jittery, with impulse of emotion dysregulation as a mediator, and aversion sensitivity indirectly predicted guilty, with non-acceptance of emotion dysregulation as a mediator.

Anxiety sensitivity indirectly predicted negative affect, with strategies of emotion dysregulation as a mediator in this pathway. This pathway included all negative affect factors in BPD, and strategies were most predictive among all emotion dysregulation variables. This result is consistent with a review paper, which used the DERS to examine negative affect in BPD. Both results showed that the relationship between lacking strategies in emotion regulation and negative affect were strongest among all emotion dysregulation variables in BPD[25]. How does emotion dysregulation lead to greater negative affect in BPD? A review the items of emotion dysregulation, including "When I am distressed, I believe that I will become depressed," "When I am distressed, I believe I will be like this for a long time," and "When I am distressed, I feel like I am awful" suggests that higher scores in emotion dysregulation are reflective not only of a lack of adaptive emotion regulation skills, but also a feeling of hopelessness when faced with a negative social situation, leading to low self-efficacy. Self-efficacy is a belief in one's abilities to compete a specific task. According to social learning theory, self-efficacy drives the motivation of individual behavior. As BPD patients usually live in a situation characterized by interpersonal difficulties and emotion dysregulation, leading to unsuccessful experiences and overwhelming emotion, BPD patients may expect that they cannot cope with negative feelings triggered by social situations, leading to a gradual decrease in self-efficacy among BPD patients. Therefore, individuals with BPD might give up on monitoring their own emotion and behavior when anxious and experiencing pressure from the social situation. However, this process becomes a vicious cycle, which leads to greater negative affect in BPD.

Second, anxiety sensitivity indirectly predicted nervousness and jittery, with impulse of emotion dysregulation as a mediator in this pathway. Impulsive behavior is one of the diagnostic criteria of BPD, and particularly impulsive self-injurious behavior, including gambling, overeating, substance abuse, unsafe sex and dangerous driving[19]. Several studies have examined impulse of emotion dysregulation in BPD, but most have just directly measured impulsive behavior patterns, including delay of gratification, behavioral inhibition, and escape learning[17,26]. Some studies have pointed out that with more frustrated feelings, impulsive reactions will increase[27]. However, few studies have investigated the relationship between impulsivity and other emotion dysregulation variables. This study found that subjective feelings of strength of anxiety can predict impulse of emotion dysregulation, consistent with the research of Chapman et al.[28], which showed that after watching anxiety- or fear-related films, individuals with BPD show increased impulse reaction to a greater degree than does a control group. This relationship contains not only alertness of but also expectation of negative events. Therefore, others' anxious behaviors may trigger higher alertness and pressure for BPD patients in interpersonal situation. Coupled with lower pain tolerance in BPD, these factors are likely to cause impulse in emotion dysregulation.

The study also found that higher anxiety sensitivity is more predictive of jittery and nervousness in BPD through impulse of emotion dysregulation. Jitters and nervousness are similar emotional states, where highly neurotic individuals often have lower emotional stability, more impulsive behavior, and are more likely to experience anxiety, depression, anger, and other negative emotions[11,29]. Self-destructive behavior, which is common in BPD patients, often leads to higher individual negative feelings after events. Frequent loss of control of either emotion or behavior can cause self-directed negative feelings, and make individual unable to form a stable self-concept, which is one of the main features of jitters. Therefore, when BPD patients experience others' anxiety in interpersonal situations and use impulsive behavior as an emotion regulation method, even if their anxiety remits in the short

term, it may still progress into feelings of jitters and nervousness.

Third, aversion sensitivity indirectly affects guilt, where non-acceptance of emotion dysregulation is a mediator. In social interactions, BPD patients are usually over-sensitive and expect negative interactions. For example, patients experience fear of being abandoned, an inability to tolerate loneliness, and so forth. This characteristic leads BPD patients to experience higher rejection sensitivity, including the expectation of being rejected, tendency to interpret social behaviors as rejection, and higher reaction when they feel any implication of rejection[30]. In addition to negative affect sensitivity, BPD patients tend to seek others' approval and lack self-affirmation, which leads BPD patients to play the submissive role in social interaction. As time passes, they usually show unstable and nervous interpersonal relationships[31]. Overall, because aversive emotion expresses a rejection of dominance[1], the negative interpersonal schemes of BPD patients are usually triggered by their aversion sensitivity. This explains why BPD patients' negative affect can be triggered by others' aversive behaviors.

Fear of being abandoned and rejected is the biggest issues for BPD patients. Therefore, others' aversive emotions would trigger considerable negative affect in BPD patients. However, this study discovered that the aversion sensitivity of BPD patients can predict their guilty. Non-acceptance of emotion dysregulation is a mediator in this pathway, which verifies Linehan's theory of invalidating environments and secondary emotions. In other words, when BPD patients face overwhelming negative affect, they tend to feel invalidation towards themselves, such as mistrusting their own feelings, regarding their emotions as nothing, and even punishing themselves. These self-invalidation responses stem from emotional invalidation in the development process, which leads BPD patients to blame themselves when they experience inner emotions or try to express emotions. Then, guilt is triggered by these self-critical situations[3]. In the present results, when BPD patients experience others' aversive emotions, they tend to have negative affect. This process of experiencing inner emotions makes them feel guilty. When BPD patients try to express their emotion, they tend to blame themselves. This process of self-invalidation (non-acceptance) would trigger their self-criticism and increase their guilt.

There are three limitations of the present study. First, this study recruited clinical patients with BPD, and did not address a community sample of BPD. Therefore, the results apply only to clinical patients, such as interventions for impulse control, developing appropriate strategies, and acceptance of one's own emotions when facing anxious situations. Second, the sample size was relatively small, and a more comprehensive statistical analysis should be conducted. Thus, a larger sample should be recruited and examined by path analysis or structural equation modeling to understand overall emotion dysfunctions in BPD. Third, there is more female (N=26) than male (N=5) BPD were recruited in the present study, since BPD has been viewed by clinicians as a female-specific disorder[32]. The DSM-5, for example, indicated that approximately 75% of individuals diagnosed with BPD are females[33]. However, the more male BPD subjects should recruit in the future study. Moreover, the control group should also recruit to compare the clinical group and more comprehensive statistical analysis should conduct in the future study.

CONCLUSIONS

This study found that negative emotions expressed by people in a social context may trigger negative emotions in BPD patients, as well as difficulties in regulating emotions. The finding suggests that, during treatment and intervention, in addition to improving patients' emotional regulation skills, clinical institutes should focus on awareness and understanding of others in a social context, such as integration of social cues, attention biases and corresponding modification treatments, and attribution of emotional expressions. Institutes can then develop an intervention, starting from basic human interaction, with specific emphasis on anxiety and disgust, to maximize the effectiveness of treatment. Among all types of emotional dysregulation, limited access to emotional regulation strategies, impulse control difficulties, and non-acceptance of emotional responses were found to mediate the relationship between BPD patients' negative emotion sensitivity and negative affect, indicating that these three forms of emotional dysregulation should receive prioritized intervention during treatment. The findings of this study conform to the concepts proposed by Dialectical Behavior Therapy (DBT) and Mindfulness-Based Cognitive Therapy (MBCT), which emphasize learning to bear pain skillfully to avoid self-harm behaviors, and utilizing meditation to observe one's emotions with acceptance to avoid self-judgment or criticism. In addition, this study discovered that limited access to emotional regulation strategies played a mediating

role in the relationship between BPD patients' anxiety sensitivity and overall negative affect. This finding suggests that patients can be trained in simple and feasible emotional regulation skills, which can be acquired within a short period, improving crisis management capabilities and self-efficacy, as well as reducing negative affect. Accordingly, this should be a priority during early intervention.

FOUNDING

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TABLES

Table 1. Correlation of emotion sensitivity, emotion dysregulation, negative affect in BPD

Variables		Emotion Sensitivity			Emotion Dysregulation						Negative Affect
		1	2	3	4	5	6	7	8	9	10	11
emotion sensitivity	1 Sad	-										
	2 Anger	.443*	-									
	3 Anxiety	.574**	.642**	-								
	4 Aversion	.887**	.506**	.506**	-							
Emotion Dysregulation	5 Non-acceptance	.423*	.240	.558**	.410*	-						
	6 Goal	.229	.241	.390*	.234	.345	-					
	7 Impulse	.198	.208	.363*	.235	.382*	.773**	-				
	8 Awareness	-.254	-.070	-.194	-.133	-.149	-.115	.100	-			
	9Strategies	.318	.096	.349	.345	.573**	.698**	.847**	-.104	-		
	10 Clarity	-.208	-.051	.117	-.177	.148	.287	.308	.449*	.213	-	
11 Negative Affect		.380*	.164	.519**	.412*	.426*	.517**	.648**	.088	.665**	.263	-

*$p < .05$; **$p < .01$; ***$p < .001$

Table 2. Hierarchical regression in negative affect of BPD

Variables	Negative Affect	
	M1	M2
	β	*β*
Step 1 (Emotion Sensitivity)		
Sad		
Anger		
Anxiety	.52**	.33*
Aversion		
Step 2 (Emotion Dysregulation)		
Non-acceptance		
Goals		
Impulse		
Awareness		
Strategies		.55**
Clarity		
ΔR^2	.27**	.27**
R^2	.27	.54
Adj. R^2	.24	.50
F	10.30**	15.56***

*p < .05; **p < .01; ***p <.001

Table 3. Hierarchical regression of negative affect in BPD

		Irritable	Distressed	Shamed	Upset	Jittery	Guilty	Scared	Hostile	Nervous	Afraid
		β	*β*	*β*	*β*	*β*	*β*	*β*	*β*	*β*	*β*
Step 1 Emotion Sensitivity	Sad										
	Anger										
	Anxiety	.32	.13		.20	.34*		.23	.38*	.39*	
	Aversion						.35*				.29
	ΔR^2	.18*	.13*	-	.16*	.31**	.28**	.17*	.14*	.29**	.15*
Step 2 Emotion Dysregulation	Non-acceptance						.43**				
	Goals	-.50*									.40*
	Impulse	.80**			.58**	.60***				.41*	
	Awareness										
	Strategies		.66***	.57**				.53**			
	Clarity										
	ΔR^2	.27*[a]	.39***	.33**	.29**	.31***	.15*	.25**	-	.14*	.15*
	R^2	.45	.52	.33	.46	.62	.43	.41	.14	.43	.29
	Adj. R^2	.38	.48	.30	.42	.60	.39	.37	.11	.39	.24
	F	7.01**	14.31***	13.46**	11.45***	22.32***	10.30***	9.53**	4.62*	10.23***	5.64**

*$p < .05$; **$p < .01$; ***$p < .001$ [a] It's total ΔR^2 of step 2.

Table 4 Bootstrap results of emotion dysregulation between emotion sensitivity and negative affect in BPD

Independent variable (IV)	Mediating variable (M)	Dependent variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct Effect (c')	Indirect Effect		Total Effect(c)
						(a x b)	95%CI	
Anxiety Sensitivity	Strategies	Negative Affect	1.12*	1.07***	2.04*	1.20	.35, 2.82	3.24**
Anxiety Sensitivity	Impulse	Jittery	1.07*	.18***	.30*	.19	.07, .42	.49*
Aversion Sensitivity	Non-acceptance	Guilty	.99*	.10*	.19*	.09	.02, .24	.28**
Anxiety Sensitivity	Impulse	Nervous	1.06*	.11*	.31*	.12	.03, .29	.42**

*$p < .05$; **$p < .01$;*** $p < .001$

Emotion Sensitivity and Negative Affect in Borderline Personality Disorder: Role of Emotion Regulation

邊緣性人格疾患之情緒敏感度與負向情感：論情緒調節的角色

葉在庭[1,*]　曾亦涵[1]　劉珣瑛[2]

中文摘要

背景：邊緣性人格疾患是一種以情緒調節失功能為主要臨床特徵的人格疾患，但目前較少有文獻探討該疾患在情緒調節失功能的整體架構。本研究探討情緒敏感度和情緒調節不良可預測邊緣性人格疾患者的負面情緒，以及情緒調節不良在情緒敏感度和負面情緒之間扮演中介角色。**材料與方法：**參與者 31 名邊緣性人格疾患者，其中包括女性 26 名，男性 5 名，平均年齡 33.35 歲。所有參與者都完成了邊緣性人格特質問卷、社會覺察推論測驗情的緒評估分測驗、正負向情感量表以及情緒調節困難量表。**結果：**中介分析表明，有限的情緒調節策略在焦慮情緒敏感度和整體負向情感之間有中介效果，衝動控制困難為焦慮情緒敏感度和緊張不安的中介變項，以及不接受情緒反應中介了嫌惡情緒敏感度和罪惡。**結論：**本研究的發現有重要的治療意義，即在治療中，如何使該疾患學習具適應性的情緒調節策略、接納自己的情緒、與避免自毀式的衝動行為應被視為介入的首要目的，此外如何降低該疾患對他人情緒表達的敏感度亦可作為治療介入的焦點之一。

關鍵字：邊緣性人格疾患、情緒敏感度、負向情感、情緒調節

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Original Research Article

Improving medical safety and user satisfaction through innovative medical care equipment needle removers and electronic information interchange

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ABSTRACT

Background：Insulin injection is one of the most effective treatments for glucose control. However, insulin injections may lead to a decrease in quality of life for patients due to needle sticks during the injection process, and may even result in disease exacerbation if patients are reluctant to undergo injections. ***Purpose：***Given the clinical observation and the collected feedback from unsatisfied insulin injection experiences, we presented a needle remover designed for removing needles from pen injections. It aims to alleviate the risk associated with needle loading/unloading and improve user satisfaction. ***Methods：***We have developed a novel needle remover called "Bye2NeedleStick" using 3D printing technology. In addition, we administered questionnaires related to clinical practicesto assess user satisfaction. ***Results：***Given user feedback, the application of "Needle Care" can make it easier for users to inject insulin and lead to improved results to most of the survey questions. ***Conclusions：*** The " Bye2NeedleStick" needle remover for insulin pen injection can improve safety, usability, and reduce risks in clinical use. The product will continue to be improved addressing potential issues from the feedback of users.

Keywords: 3D Printing、Medical equipment innovation、User satisfaction

Needle Care" needle remover

INTRODUCTION

Diabetes is a global chronic disease that affect around 537 million people worldwide (International Diabetes Federation,2021). Diabetes claims approximately 6.7 million livesfrom every 5 seconds (International Diabetes Federation, 2021). In Taiwan, statistics from the Ministry of Health and Welfare of the Executive Yuan pointed out that diabetes rankedthe fifth among the top ten causes of death in 2021 (Ministry of Health and Welfare, Republic of China, 2022). Innovation, characterized by novelty and ingenuity plays a pivotal role in addressing clinical challenges (Ministry of Education of the Republic of China, 2020). Since 1996, the National Association of Nurses of the R.O.C. (Taiwan) and the National Federation have annual held nursing innovation competitions, aiming at work efficiency, care quality, and patient needs, to carry out creative improvement ideas (Zhang Jiping, 2016). Healthcare professionals are often inspired for ideas of innovative applications through their process of clinical work.

1. Diabetes and insulin therapy

Insulin injection is one of the most effective treatments for controlling blood glucose in current medical care (Hong Haozhang, 2021). However, although insulin injection can achieve good blood glucose control, it also reduces the quality of patient's life satisfaction. Factors leading to lower satisfaction include insufficient knowledge about the safety of injection equipment or technology, reluctance to inject due to inability to operate, a lack of support or assistance from family members, and poor self-care function (Gao et al., 2009).

2. Innovation in the prevention of needle-sticks

The occurrence of needle-sticks often happens when the needles are being returned and disposed of after using sharp objects. Needle-sticks not only cause physical damage, but also cause serious psychological impact (Huang et al., 2020). Some research papers pointed out that the special needle design of pen needles has caused the occurrence of needle-sticks. Factors contributing to needle-stick can be summarized as individual, environment, policy-related, item design-related, involving other people and related to equipment (Fang et al., 2013). Fang Chanjuan (2017) indicated that the special needle design of pen-shaped needles has caused the occurrence of needle sticks. With the increasing use of insulin injection therapy at home, the incidence of needle-sticking accidents have extended from medical staff to patients and related caregivers who receive home injections. However, the awareness and education of patients at home to properly dispose of sharp objects are often neglected. In the absence of needle-stick prevention guidelines, it is unsafe to handle the needle tip, turn the needle away, remove it, and return it by hand (Zhang et al., 2014).

Nursing professionals have played an important role in innovative research in recent years, expecting that innovative technologies and concepts can be implemented in clinical practice and nursing education (Lian et al., 2014). Among them, those in the department that retaining higher innovative atmosphere, people not on work-shifts, those at management level, and nurses exhibit better innovation behavior (Lin et al., 2021). Because nursing professionals can easily discover patients' needs and difficulties of medical care during clinical practice, they can provide team nursing professional information when participating in product or service development, and use their own professional knowledge to improve medical quality and improve the patient's pathological situation (RODDY & POLFUSS, 2020). The process of design thinking includes five steps: "empathy observation (EMPATHIZE), definition problem (DEFINE), creative idea (IDEATE), prototyping (PROTOTYPE), test feedback (TEST)" (Guo et al., 2021). Use the above thought process to design innovative patient-centered products.

Purpose

Using the five steps of the design thinking process, and through clinical observations and collecting bad experience of injectors who use pen-type insulin needles to cause needle-sticks, we have produced a needle-unloading seat that can help remove pen-type insulin needles to reduce the risk of needle contact directly when disposing needles. At the same time, in order to improve the compliance with the doctor's order for insulin injection and collect the medical data of the patient's insulin injection, the reminder clock and the recording device are set into this device, and the time of using the needle and removing the needle is recorded. The above information can be used to improve the patient's compliance with the doctor's orders for insulin injection, and provide medical staff to analyze the patient's long-term injection manner. This article expects to provide doctors, case managers, and relevant medical professionals with the results of relevant data collection and

analysis to assess whether patients have medication on time or encounter difficulties of operation. Appropriate solutions can achieve the goal of good blood glucose control for diabetics.

MATERIALS AND METHODS

1. "Needle Care" needle remover for insulin pen injection

Find out the cause of needle-sticking caused by traditional clinical injection of pen-type insulin, and use 3D printing technology to produce a pen-type insulin syringe made of ABS resin to needle remover for insulin pen injection - "Needle Care". Combination of common clinical insulin injection question, we use the Arduino development board with other electronic components, a screen display panel, a reminder function clock, and the SD card which record the number and time of pressing the button of the needle unloading seat (Figure 1). Through analyzing the time of loading and unloading the needle, the patient's situation can be evaluated. The data of time for actually injecting insulin and uploading relevant to the information system for analysis can help doctors further understand the long-term trend of patient medication as an auxiliary basis for treatment. The recording logic for time of unloading the needle system is shown in Figure 2.

2. Analysis of the clinical data of the needle remover for insulin pen injection

(1) Subject acceptance conditions:

Patients with type 1 or type 2 diabetes who have been taking pen-type insulin for more than three months and who are at least 20 years old, or cooperating family members of patients who match the above conditions. Thirty patients are planned to be admitted. The author recruited either diabetic patients who injected insulin themselves or caregivers who assisted them in the diabetes clinic cases.

(2) Research methods:

The patients included in this study were those who injected pen-type insulin themselves or caregivers assisting with insulin injection. The basic information of the patients was recorded and the pre/post -test questionnaires were collected for the experience of the injectors in using pen-type insulin. The answer part is filled in with a five-point Likert scale on the questionnaire. The study period spanned from June 1, 2019 to December 31, 2020, and it has received approval from the IRB review (CYCH-IRB2019041). After the case was accepted, the researchers visited the place of acceptance to provide guidance and demonstrate the operation process of the system and the employ the following evaluation criteria to ensure that the operation process of each accepted case is consistent (Figure 3). we confirmed that the operator could comply with the process of using the needle unloading system in each case, and also provided the needle unloading system free of charge to the participants in this study. After a three-month period, the operators were asked to fill out the post-test questionnaire. We analyzed the questionnaire to assessthe patient's satisfaction with the use of the needle unloading system in this case. However, due to a limited number of returned questionnaires, the analysis will be based on comparison of means in this study.

(3) Assessment indicators

1. Analyze and compare the questionnaires before and after the using to find out whether the needle-removing hub can help the case reduce needle-sticks and correctly inject pen-type insulin.

2. Analyze and compare the answers to the questionnaire before and after the test, so as to know whether the needle unloading system can help the case to inject insulin on time and reduce the frequency of forgetting for the injection.

3. Collect patients' subjective opinions on using the needle unloading hub. Different from the content of the questionnaire, the provision of such opinions can complement the feedback beyond the content of the questionnaire, so as to better understand different opinions.

(4) Data Statistics

Data for this study were analyzed using Microsoft Excel software (Microsoft, USA). The results are presented as mean ± standard deviation (SD). Differences between the two groups were analyzed using paired sample Student's t-test. A significance level of $P < 0.05$ was considered statistically significant.

RESULTS

1. The clinical application of " Needle Care "

A total of 31 samples were recovered in this case. In addition, there were 2 cases who quit halfway because they did not meet the inclusion conditions. These 2 cases had right limb weakness due to past stroke history. During the nurses intervention period and patient-instructions, patient did have difficulties in implementing pen-type insulin injection techniques. After using the " Needle Care",

they were able to successfully complete the technique of self- injecting pen-type insulin. However, the two cases were diagnosed as insulin-dependent diabetics for the first time at that time, and they did not match the subject acceptance conditions of this case: Patients with type 1 or type 2 diabetes who have been taking pen-type insulin for more than three months and who are at least 20 years old. This case was also changed to oral hypoglycemic drugs after one month of follow-up in this case, and he withdrew from this research case. Through the experience of using " Needle Care " in this case, we also collected information that "careful needle" can really help patients for taking pen-type insulin with poor hand function.

The memory card inside the "Needle Care" can record the time of injecting insulin and the total time spent during loading to unloading the needle. This study only collected the usage data of 6 cases, because the power supply used by "Needle Care" comes from the power supply or an external mobile power supply. If the socket is not plugged in or the power of the mobile power supply is insufficient, the data and time of injection may not be collect successfully when patients operated "Needle Care". By case interviews, the experience of the cases was collected.

By case 1: "I think it is very helpful to remove the needle when covering the needle head cover, and the base is also very stable!".

By case 2: "I think it is very helpful for injections and I would like to introduce it to my relatives!".

By case 3: "Although I don't use it now, it will be very helpful when my hand function deteriorates in a few years!".

2. Data Analysis of the " Needle Care " Questionnaire

(1) Analysis of the pre-test questionnaire:

In this study, a total of 31 cases were accepted. The timing of needle-sticking was investigated by questionnaire. There were 4 cases before loading the needle, 3 cases during loading, and 18 cases when the needle was unloaded after injection. This indicates that the timing of needle-sticking predominantly occurred when unloading the needle. The average age of the cases accepted was 63 years old, which includes 16 were men and 15 were women. At the time of enrollment, the average glycated hemoglobin (HbA1c) level of the enrolled subjects was 9.5%, and the average fasting blood glucose was 168 mg/dl. According to the questionnaire survey in this trial, about 86% of the volunteers think that the blood glucose control are not well, 72% of the volunteers often forget the time to inject insulin, 76% of the volunteers are afraid of injecting insulin, 63% of the volunteers thought it was difficult to adjusting the dose scale,65% of the volunteers thought it was difficult to inject insulin, 67% of the volunteers thought it was difficult to install the needle, and 73% thought it was difficult to re-cover the needle after injecting. The above shows that the volunteers generally reach a consensus that they have different levels of difficulties and obstacles for insulin injection.

(2) Post-test questionnaire analysis:

In the post-test questionnaire survey of this study, the average blood glucose of the enrolled subjects decreased from 9.5% to 7.5%, and the average blood glucose was 133 mg/dl. The post-test questionnaire survey revealed the following findings after using "Needle Care": 67% of the respondents believed that "Needle Care" could effectively control blood glucose ($p = 0.0107$), 59% of the respondents felt that "Needle Care" helped remind them to administer insulin ($p = 0.0176$), 66% of the respondents still experienced occasional difficulties in remembering the time to administer insulin. The percentage of respondents who were afraid of administering insulin decreased to 67%, 62% of the respondents found that "Needle Care" made the process of insulin administration simpler, 59% of the respondents believed that "Needle Care" aided in adjusting the insulin dosage scale, 61% of the respondents found that using the "Needle Care" device made needle insertion easier, 61% of the respondents believed that "Needle Care" assisted in recovering the needle after administration.

66% of the respondents felt that they were no longer afraid of needle sticks when using "Needle Care". Based on the compiled statistics from the survey content, it can be concluded that after using "Needle Care," significant improvements were observed in the difficulties and obstacles faced by the respondents in insulin administration. (Table 1)

(3) Comparative Analysis of User Satisfaction

According to the content of all the questionnaires collected in this study, we compared the averages of each item, and we found that there were many problems in "Unsatisfactory blood glucose control", "Frequency of forgetting the time to inject injections", "Fear of injecting injections", "Difficulty in injecting the needle", "Difficulty in installing the needle", "Difficulty in returning the needle cover",

and "Safety concerns about needle operation" have all improved the satisfaction after use, while in questions such as "Frequency of forgetting the time for insulin injections" and "Difficulty in adjusting the insulin dosage scale", there was a slight decrease in satisfaction compared to the average.

DISCUSSION

This final product of the insulin-pen-needle-remover has been patented as utility model patent No. I708623 (Figure 4). This study is to test "Needle Care" needle remover for insulin pen injection, hoping to improve medical safety and user satisfaction, and continue to track the follow-up of the case using, and then collect the good experience and advantages, such as: "It is very helpful to remove the needle seat when covering the needle head cover.", "The base is very stable and very helpful for injections.", "I want to introduce it to relatives and friends.", "It is very helpful for someone hand function degradation.". According to results, users have improved their usage habits and satisfaction after using "Needle Care". However, some problematic items may not improve significantly or regress due to insufficient samples. We will continue to improve these undesirable situations and conduct follow-up studies to further improv "Needle Care". During the interviews, we know that the memory card installed inside the "Needle Care" failed to successfully record the time and data. Because the power of "Needle Care" comes from the socket power supply or an external mobile power supply. The injection time and data cannot be recorded when patients operate "Needle Care" without the socket being plugged in or if the mobile power supply is insufficient. Therefore, if the power supply equipment can be placed into the "needle care" casing, it should be able to collect the injection time and data of the case more exactly.

CONCLUSIONS

The needle unloading hub has effectively utilized the advancement of medical equipment innovation to improve both the safety and satisfaction of medical usersFurther refinement are warranted to optimize the needle unloading hub in the future.

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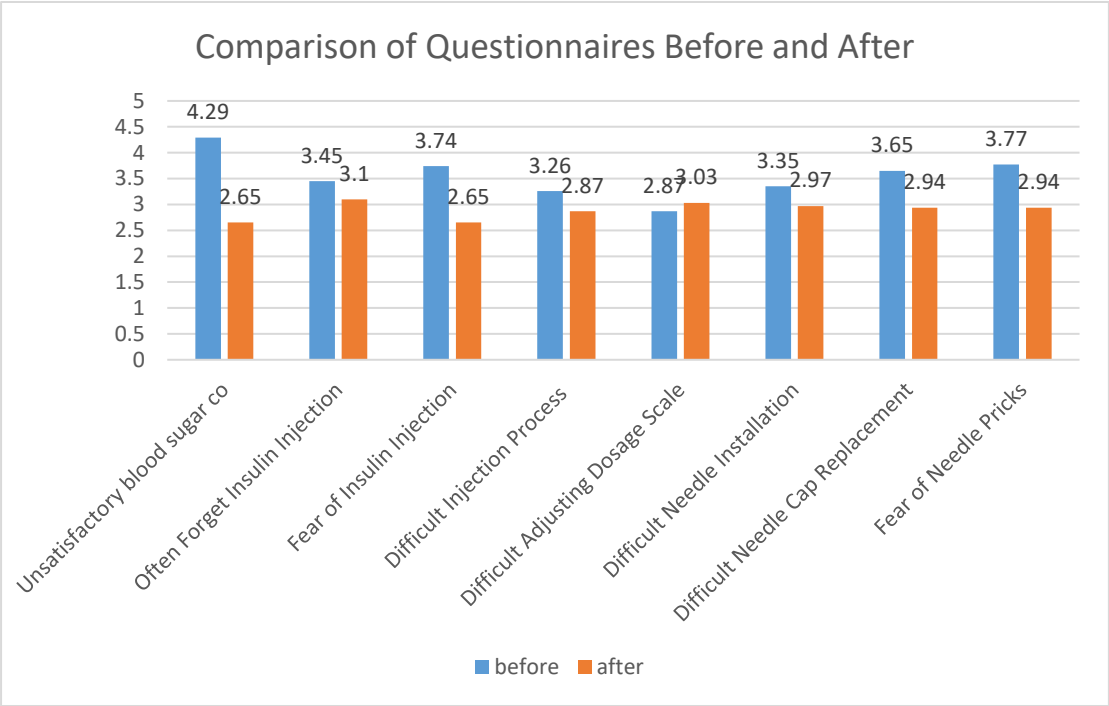
Needle Care" needle remover

TABLE

Table1. Analysis of Pre-test Post-test.



Needle Care" needle remover

FIGURE AND FIGURE LEGENDS

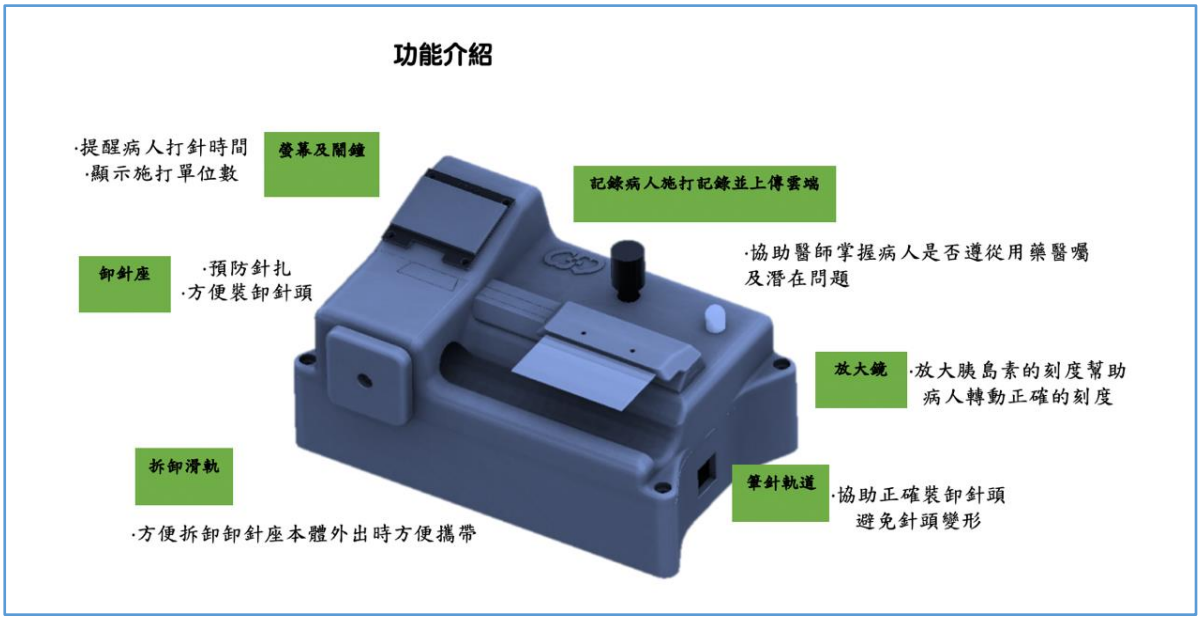


Figure 1. Introduction to the function of needle removal base in 'Needle Care"

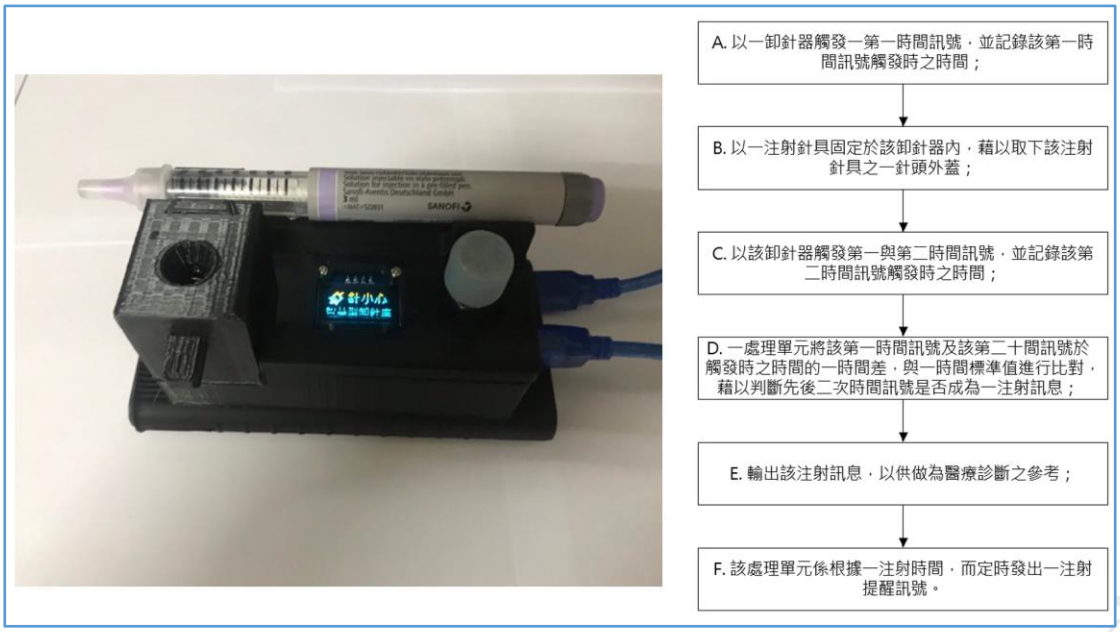


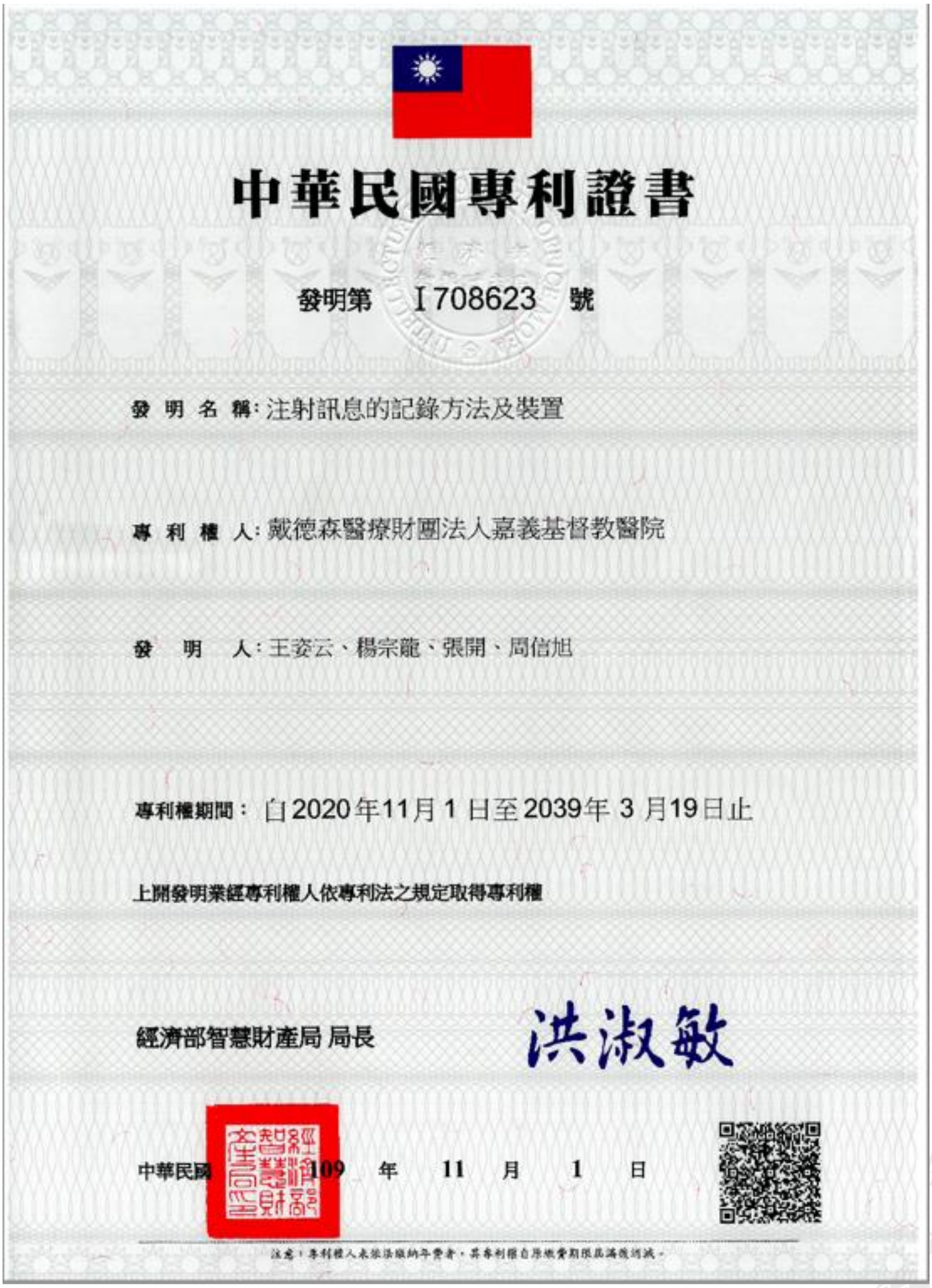
Figure 2. Time recording logic diagram

針小心 - 智慧筆型胰島素注射器安全卸針座操作評估表

個案編號：　　評估日期：　年　月　日

步驟	項目	執行狀況 如有達成請打勾	備註
1	按下按鈕將針頭放置卸針座上		
2	筆型胰島素注射筒消毒		
3	撕開針頭上的塑膠膜		
4	將筆型注射筒插入胰島素針頭		
5	旋轉筆型胰島素將針頭固定		
6	轉緊後利用卸針座打開外蓋及蓋子內的小塑膠保護蓋		
7	施打部位選擇		
8	施打完畢後，利用卸針座回套針頭蓋		
9	利用卸針座旋轉針頭卸針		
10	按下卸針座側邊的按鈕，將針頭丟棄至卸針桶，完成施打胰島素的護理工作。		

Figure 3. Criteria for evaluating the operation of 'Needle Care' instructions



中華民國專利證書

發明第 I708623 號

發 明 名 稱：注射訊息的記錄方法及裝置

專 利 權 人：戴德森醫療財團法人嘉義基督教醫院

發 明 人：王姿云、楊宗龍、張閑、周信旭

專利權期間： 自2020年11月1日至2039年3月19日止

上開發明業經專利權人依專利法之規定取得專利權

經濟部智慧財產局 局長 洪淑敏

中華民國 109 年 11 月 1 日

注意：專利權人未依法繳納年費者，其專利權自原繳費期限屆滿後消滅。

Figure 4. Granted utility model patent No. I708623

Needle Care" needle remover

Improving Medical Safety and User Satisfaction through Innovative Medical Care Equipment Needle Removers and Electronic Information Interchange

利用創新醫療器材卸針裝置及資訊傳遞系統提升醫療安全及使用者滿意度

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中文摘要

背景：胰島素注射為糖尿病患控制血糖效果最佳的治療方式之一，然而胰島素在注射過程中可能因為針扎而導致病人生活品質下降，甚至不願意施打而造成疾病惡化。**目的：**藉由臨床觀察、蒐集施打者使用筆型胰島素針扎時機之不良經驗，製作出可協助移除筆型胰島素針頭之卸針座，降低施打者雙手在裝卸針頭時直接接觸針頭的風險，並提升使用者滿意度。**方法：**利用 3D 列印，製作出以 ABS 樹脂為材質的筆型胰島素注射器安全卸針座—「針小心」，結合臨床施打胰島素常見的問題製作前後測問卷，並依此蒐集受測者資料，比較前後滿意度。**結果：**在使用者回饋上，卸針座的應用可讓使用者更易於胰島素注射，並得到大部分問項上皆有所改善的結果。**結論：**「針小心」在使用上可提升醫療安全性，另也使使用者更便於進行胰島素注射，未來也將持續針對使用者回饋意見進行改善。

關鍵字：3D 列印、醫療器材創新、使用者滿意度

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Case Report

Resolution of arachnoid cyst after development of chronic subdural hematoma and burr hole surgery - a case report

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ABSTRACT

Arachnoid cyst (AC) is usually asymptomatic, incidentally-found, and a well-known risk factor of developing chronic subdural hematoma (CSDH) after minor head injury in young patients. Spontaneous remission or rupture of arachnoid cyst is very rare. When chronic subdural hematoma occurs, burr hole drainage is indicated if mass effect presenting. Only the hematoma is drained, where the cyst is left untouched. Although the chance of an arachnoid cyst to disappear is low, here we presents a case where the AC disappears after burr hole operation. We subsequently discuss the possible pathophysiological mechanisms and the relevant literatures.

Keywords: Arachnoid cyst, Chronic subdural hematoma, Burr hole, Spontaneous resolution

INTRODUCTION

Arachnoid cysts (AC) are developmental anomaly and usually diagnosed in childhood on imaging study for other reasons, because they are frequently asymptomatic. AC accounts for nearly 1% of intra-cranial lesions. It is known that patients with AC are at higher risk to develop a chronic subdural hematoma (CSDH) after minor head injuries. AC usually remains unchanged after CSDH resolution or drained. However, we reported a case that an AC disappeared after only draining the CSDH.

CASE REPORT

A 15-year-old woman committed a head injury from a traffic accident and presented with headaches and dizziness. The CT scan showed mild brain edema and a 3 cm sized cystic lesion in the right temporal region, which was compatible with an incidentally found arachnoid cyst (Figure 1).

Three months later, she developed a worsening headache for two weeks and the follow-up CT scan showed a right F-T-P chronic subdural hematoma with mass effect (Figure 2). Surgical intervention with two burr holes irrigation and drainage of the darkish liquefied hematoma was done. She had a smooth recovery. Four months later the follow-up CT scan demonstrated total resolution of CSDH and the arachnoid cyst was no more visible(Figure 3).

This study was approved by Institution-al Ethics Review Board (permission number: 20220907R).

DISCUSSION

CSDH tends to occur in elderly due to cerebral atrophy after aging[1]. The mechanism is stretching of the bridging vein between dura and cortex, causing vessel rupture even in minor injuries.

On the other hand, AC is believed to be congenital and usually diagnosed in young patients[2]. Although mostly asymptomatic, symptoms might occur due to high intracranial pressure, for example headache, nausea, and vomiting. Trapping of CSF from single-way valve opening on the cystic wall resulted in increase of the size of AC, then the elevation of intracranial pressure[3,4]. It is now well-known that these two distinct etiologies have relationship and it is not uncommon to have AC-associated CSDH after minor head injuries[5]. The first literature describing AC associated with CSDH was by Davidoff and Dyke in 1938[6]. Since then, cases of CSDH in association with AC have been reported.

Pathophysiological mechanisms have been proposed to explain the association between these two distinct entities. First, the presence of AC weakens the junction between the dura and the arachnoid membrane, which makes it easier to bleed with minimal or no trauma[7]. Second, the vessels around the cystic wall and the nearby bridging veins are stretched, which is like brain atrophy in elderly, and fragile. So these vessels are vulnerable to minor trauma and tend to bleed even spontaneously, which then resulting in CSDH.

The optimal treatment is still unclear, whereas multiple treatment modalities are rationale and yield similar results, including burr hole drainage without fenestration of the cyst or craniotomy/craniectomy with both drainage and fenestration. Reviewing the available literatures, burr hole drainage of the blood clot has gradually been the first choice, since it is less invasive than the traditional craniotomy/craniectomy, thus can also decrease length of the hospital stay and economical burden8. It is known that manipulation of the arachnoid cyst wall, including fenestration or resection, is not mandatory in such patients with previous asymptomatic arachnoid cysts[9].

Although there is relation between AC and CSDH, they are still separated inside the cranium[10]. The CSDH locates within subdural compartment and has pseudomembrane formation, whereas an AC stays intra-arachnoid. So it is reasonable for patients with asymptomatic AC to receive drainage for blood clot only and still has good surgical outcome with AC remaining intact[11, 12].

Spontaneous AC disappearance is a rare phenomenon and there is little literature about AC disappearance after minor head injury. Most authors agreed that the resolution of AC is due to the rupture of the AC membrane. There are two possible etiologies. The first is due to trauma-related membrane rupture. Intracystic fluid flows into the subdural space, forming fluid collection. Subdural hematoma will occur if the bridging vessels rupture concurrently, and then progressed to CSDH[13].

The second etiology of membrane rupture is due to water irrigation during burr hole procedure[14].

Then the AC disappears after drainage of the CSDH with subsequent brain expansion. It is hard for CSF to re-accumulate since the membrane is not integrated.

CONCLUSION

AC has relationship to AC-associated CSDH and might disappear after removal or resolution of CSDH, regardless of direct management to the AC itself. Burr hole drainage for only CSDH is suggested once CSDH causes symptoms. There is a chance that the AC will disappear afterwards.

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FIGURE AND FIGURE LEGENDS

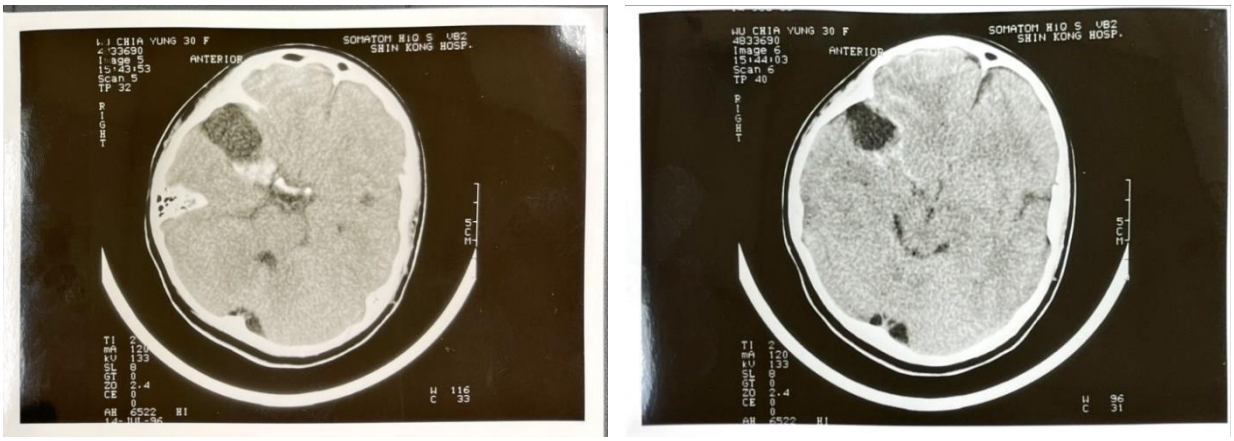

Figure 1. Axial view of CT showing right temporal tip arachnoid cyst with some SDH and SAH, caused by head trauma.

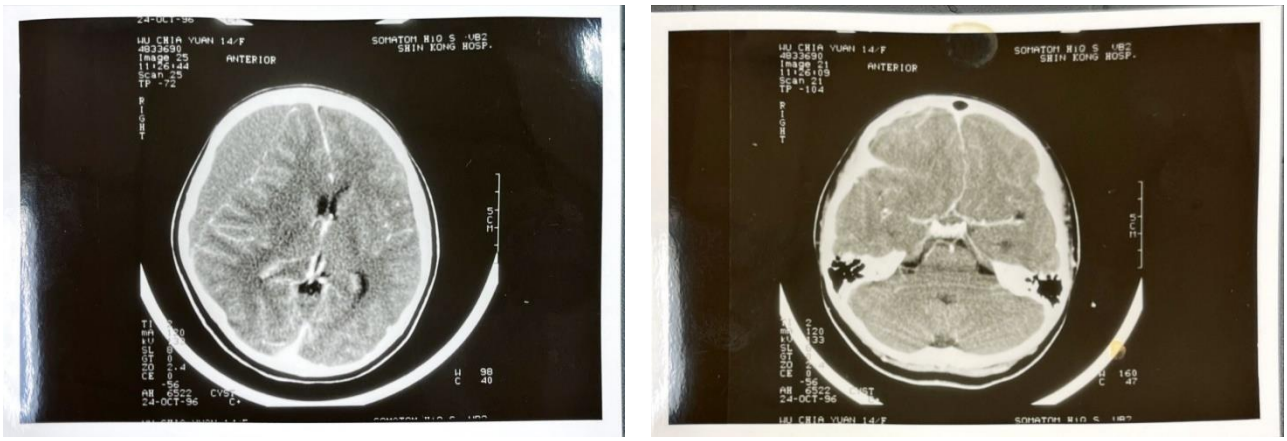

Figure 2. CT scan after 3 months showing right CSDH with mass effect and midline shift. The AC seems to disappear.

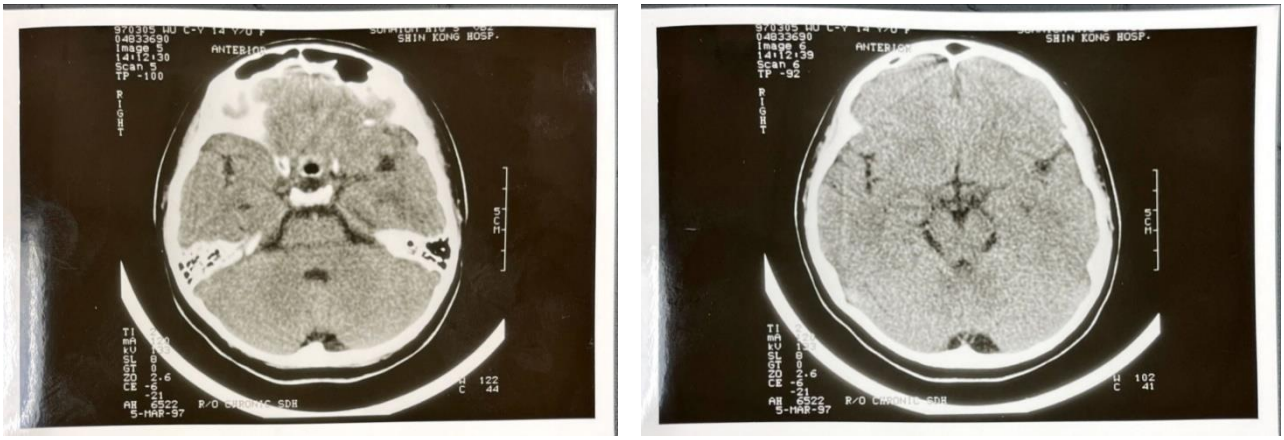

Figure 3. Follow-up CT scan showed complete resolution of CSDH and AC after burr hole craniotomy.

Spontaneous resolution of arachnoid cyst

The Appearance of Optic Neuritis in Non-Infectious Uveitis with Cystoid Macula Edema

鑽孔手術治療慢性硬腦膜下血腫後蜘蛛網膜囊腫的消退

－病例報告

賀星皓[1,] 蔡明達[1,2,*]

中文摘要

蜘蛛膜囊腫是先天性且通常無症狀的顱內病灶，自行消失的案例非常罕見，已知有此病灶的病人較一般人於輕微頭部創傷後引發後續的慢性硬腦膜下血腫，若造成腦部壓迫之症狀，臨床上通常會進行顱骨鑽孔引流手術，只引流血水並不會去特別處理囊腫，但在極少數情況下，囊腫會在術後追蹤時被發現慢慢消失。我們報告一例蜘蛛膜囊腫在接受硬性硬腦膜下出血手術後消退的案例，探討其可能的病生理機轉和相關文獻回顧。

關鍵字：蜘蛛膜囊腫、慢性硬腦膜下血腫、鑽孔手術

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Case Report

Cerebrospinal fluid in the epidural space accidental finding in spontaneous intracranial hypotension headache cured by epidural blood patch - case report

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ABSTRACT

Spontaneous intracranial hypotension headache (SIH) is a phenomenon combined with postural headaches, cerebrospinal fluid (CSF) leakage often at spine level on magnetic resonance imaging (MRI). We present a patient with SIH with CSF leakage blow thoracic (T1) spine vertebral level presence of posterior epidural space CSF on MRI and received lumbar puncture to excluded meningitis. The patient received conservative treatments but in vain. Some CSF was found in lumbar epidural space (L3-4) during aempiric lumbar epidural blood patch (LEBP) treatment 5 days later. The patient was pain relief immediately. We discuss the pathophysiology, proposed etiologies and treatments, and safety of LEBP anesthesia in spontaneous intracranial hypotension, and a rare case is found CSF far away to the target CSF leakage site.

Keywords: spontaneous intracranial hypotension headache, lumbar puncture, cerebrospinal fluid, epidural blood patch

INTRODUCTION

Headache, pain in any region of the head, is a common disease which affects the daily life of many people. A headache may appear as a dull pain, a sharp pain or a throbbing sensation. According to the International Headache Society (IHS), headaches are categorized as primary and secondary[1]. Orthostatic headache (postural headache) is a rare headache which cause by spontaneous spinal cerebral fluid(CSF) leak and/or CSF hypotension.It is common caused by spontaneous intracranial hypotension headache (SIH).[2] The rare prevalence (5 in 100,000[2]) leads the easy misdiagnosis of SIH.

The epidural blood patch (EBP) is a procedure for treatment of SIH or post-dural puncture headache.[3] The practitioner injects some autologous blood into a patient's epidural space for stop CSF leak. The epidural space is a space of spinal anatomy which is located between the spinal cord and the vertebral canal. There is no fluid normally.

This case report describes a patient with SIH who underwent lumbar puncture and receive

the lumbar EBP which was noted some CSF in the epidural space. The CSF might from the recent diagnostic lumbar puncture or the T-spine CSF leakage. The patient was recovery after two times EBP without complication. We also review the SIH presentation, diagnosis, and treatments.

CASE REPORT

We present the case of a 36-year-old female with dizziness, vertigo and orthostatic headache for several days, found to have a CSF leak throughout below thoracic (T1) spinevertebral level presence of posterior epidural space CSF on MRI (Figure1). Her neurological examination was negative. She received lumbar puncture with 20 gauge spinal needle via L4-5 space for excludedmeningitis. Colorless clear CSF and intracranial hypotension (initial pressure: 4.5 cmH20, end pressure: 4.5cmH20) were found. Postural headache and dizziness were not subsided after conservative and medical treatments (bed rest, hydration and ketorolac 30mg im Q8H prn). She received a lumbar epidural blood patch (EBP) treatment for SIH after lumbar puncture 5 days later. We performed epidural injection with epidural needle (Tuohy needle,18g x 80mm, Protex®) smoothly and confirmed of the needle entry into the epidural space by lost of resistance (LOR). Some xanthrochromic fluid about 10 mL was found in lumbar epidural space (L3-4) (Figure2). There was no more fluid could be aspirated from the space. We test with a test dose 2 mL of 1% xylocaine and 10 μg of epinephrine. After 5 minutes later, no motor block or numbness was noted. We gave the patient 10 mL EBP. Her postural headache relived immediately. The fluid we sent to examination found, leukocytosis, Pandy's test 4+, glucose 130mg/dL, total-protein 480.0mg/dL, LDH 111U/L. Unfortunately, she felt dizziness and orthostatic headache at that night. Therefore, we performed EBP via L2-3 space next day. There was clear, no CSF or blood clot during epidural injection 2 day days later after fist EBP. She received 15 mLEBP with mild back pain this time. After the two times EBP the dizziness, vertigo and orthostatic headache was resolved, she was discharged. One year after the second EBP, the patient continued to be headache free.

DISCUSSION

SIH is very easy misdiagnosed.[2,4] The rare incidence of SIH might be the reason. The victims of SIH are more common in females (the ratio between female and male is 2:1) and all ages are affected. The peak age of SIH is around 40 years old.[5] SIH is caused by a CSF leak caused by congenital or traumatic due to dural defects at the level of the spine and the resulting CSF volume depletion in the brain and spinal cord.

Lumbar puncture (LP) with examination of CSF is an important diagnostic tool for a variety of rule out potential life-threatening conditions (eg, bacterial meningitis or subarachnoid hemorrhage) and various other conditions (eg, demyelinating diseases and carcinomatous meningitis).[6] There are no absolute contraindications to performing the procedure. However, there are some relative contraindications (eg, possible raised intracranial pressure (ICP) with risk for cerebral herniation, thrombocytopenia or other bleeding diathesis, including ongoing anticoagulant therapy, or suspected spinal epidural abscess).[7] Our patient with the dizziness, vertigo and orthostatic headache for several days was misdiagnosed with meningitis and received the lumbar puncture. The opening pressure was 45mm H20. The diagnostic criteria of SIH include with A, orthostatic headache; B, the presence of at least one of the following: low opening pressure (<=6 cmH2O), sustained improvement of symptoms after epidural blood patching, demonstration of an active spinal cerebrospinal fluid leak, cranial magnetic resonance imaging changes of intracranial hypotension (eg, brain sagging or pachymeningeal enhancement); C, no recent history of dural puncture; and D, not attributable to another disorder. Brain magnetic resonance imaging is the most sensitive investigation and extradural cerebrospinal fluid identified in spinal neuroimaging.[8] Our patient is fully matched all the criteria. However, the clinical presentation of SIH can be variability.[2] Some of the SIH patients did not experience headaches but suffered from vertigo, diplopia or cognitive symptoms. The brain MRI is one of the most sensitive in detecting signs of SIH but there is some negative findings in SIH patient. Some investigators used bilateral greater occipital nerve blocks (GONBs) to guide the diagnosis of SIH with atypical patients.[9] The treatments for SIH included conservative treatments with bed rest, hydration, usage analgesia, steroids, caffeine, and EBP, and surgery.[10,11]

The EBP is an invasive procedure and effective. The methods,“loss of resistance,” target fluoroscopy-guided, target CT-guided with blood or fibrin glue to perform the EBP are no consensus.[10,11] The lumbar EBP is the time-honored approach therapy for conservative treatment for SIH fails. We empirically select the L3-L4 level as the initial target site for suspected SIH. Some

physicians choice L2-3 level.[12] In our experience, the L3-4 level is often resolved the SIH immediately.

The epidural space locates between the vertebral canal and the spinal cord. It lies inside the canal, but outside the cord, bounded by the dural meninges anteriorly, the ligamentum flavum posteriorly and the sides of the vertebral walls laterally. It extends from the foramen magnum to the sacral hiatus. Its contents are tiny arteries and lymphatics, epidural fat, and a network of small valveless veins (Batson plexus).[13] In normally, there is no fluid. Our patient can find the CSF in T1-T12 epidural space area no CSF in lumbar area in the MRI 5 days before the lumbar EBP (Figure1). The site of CSF spontaneous leakage is from T1 disc space. The postdural puncture headache (PDPH) is a complication after lumbar puncture.[14] The PDPH is cause by excessive loss of CSF after dural puncture leads intracranial hypotension. The pathophysiology of PDPH is similar to the SIH except "spontaneous". The patient was suffered from the orthostatic headache several days before admission, before received lumbar puncture examination. Under the medical history of the patient and the MRI findings before the lumbar examination, the patient is confirmed from SIH.

We find the xanthrochromic fluid about 10 mL in the lumbar epidural space. It does not report fluid in the epidural space far away from the target CSF leakage area. We find the fluid and aspirate clearly. We confirm the epidural space with the epinephrine and xylocaine, the local anesthetic agent. Under the history, the small amount CSF might cause from the lumbar puncture or the CSF shift under the gravity. The effective autologous blood volume of the EBP is range from 5-25 mL. Therefore, we perform the LEBP 10mL. The postural headache relived immediately. The reports do not confirm the large volume more effective but cause more incidence of nerve root irritation, back pain, and arachnoiditis .[3, 13,15-16] The patient was suffered from dizziness and orthostatic headache at the night received the first time LEBP. There was clear, no CSF or blood clot during epidural injection 2 day days later after fist EBP. The patient fully recovery after the second times LBEP with 15mL autologous blood volume. The autologous blood of the first LEBP and the leakage CSF in the lumbar space were absorbed. The finding shows the LEBP is safe and effective in the CSF finding in the epidural space. The orthostatic headache at the night in the first time LEBP might indicate the SIH in the patient need more autologous blood volume of the LEBP.

CONCLUSION

We report a rare SIH case found CSF far away the target CSF leakage site. The LEBP is effective to treatment SIH. More studies must be conducted to confirm the clinical significance of the effective autologous blood volume of the LEBP.

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FIGURE AND FIGURE LEGENDS

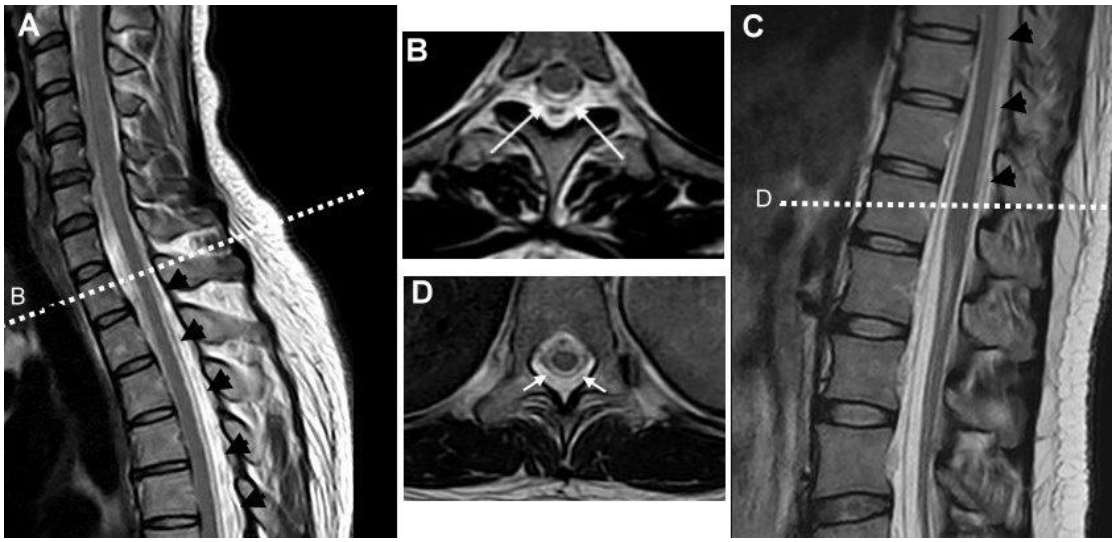

Figure 1. Spine MRI. (A) Sagittal T2-weighted image through the thoracic spine demonstrating epidural fluid collocations (black arrowheads). Axial section B and D are indicated by dotted lines. (B) Axial T2-weighted image with fat saturation at the level of the T1-2 neural foramina demonstrating dorsal epidural fluid collections (white arrows). (C) Sagittal T2-weighted image through the lower thoracic and lumbar spine demonstrating epidural fluid collections (black arrowheads). (D) Axial T2-weighted image with fat saturation at the level of the T12 neural foramina demonstrating dorsal epidural fluid collections (white arrows). The epidural fluid collections is from T1 to T12.

Figure 2. Some xanthrochromic fluid about 10 mL was found in lumbar epidural space (L3-4).

Cerebrospinal fluid in the epidural space accidental finding in spontaneous intracranial hypotension headache cured by epidural blood patch - case report

自發性顱內低壓頭痛使用硬腦膜外血液貼片治療發現硬腦膜外液體—病例報告

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中文摘要

自發性顱內低血壓頭痛(SIH)是一種體位性(姿勢性)頭痛，大多因腦脊髓液(CSF)在脊椎段發生滲漏造成，通常在核磁共振成像(MRI)可發現滲漏。本病例報告一名自發性顱內低血壓頭痛患者，在 MRI 上發現於胸部脊柱椎體(T1)以下後硬膜外腔腦脊髓液滲漏，並接受了腰椎穿刺以排除腦膜炎。此病患經過保守治療之後無效、在核磁共振檢查之後第 5 天，患者在腰椎硬膜外血液貼片(LEBP)治療時，於腰椎硬膜外腔(L3-4)中發現了一些腦脊髓液並接受腰椎硬膜外血貼片治療改善病情。我們討論了自發性低顱內壓頭痛的病理生理學、提出的病因和治療方法、腰椎硬膜外血液貼片治療的安全性以及一位在脊椎目標滲漏區間遠處發現硬脊膜外腦脊髓液滲漏之罕見病例。

關鍵字：自發性低顱壓頭痛、腰椎穿刺、腦脊髓液、硬膜外血貼片

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Brief Report

Hospital pastoral care service: promotion of "High Touch"

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ABSTRACT

The author explores the importance of "high touch" in the context of "high technology" in settings for medical care. This theme is crucial in the daily experience of patients in their time of illness. Health care is not simply a response to illness or disease. It is a holistic, lifelong engagement with the meaning of life. Patients are becoming more aware of their need for holistic care. Research indicates that "high technology" alone cannot satisfy the spiritual needs, and spiritual crises which become increasingly prominent during experiences of illness. Patients no longer tolerate "high-tech," no-touch health care. They want the best of both worlds — "high-tech" and "high-touch" care. The question, therefore, is how best to face special challenges and demands in light of future development? How can "high touch" take the necessary forward steps it needs to take in medical care?

Keywords: High touch, high technology, spiritual needs, spiritual crises.

INTRODUCTION

Fu Jen Catholic University Hospital (FJCUH) was opened on September 29, 2017. It is the newest hospital in Taiwan featuring the use of state-of-the-art, technologically sophisticated equipment, as well as the latest methods of medical care. FJCUH is attracting much attention. As of 2019, the hospital was operating with 380 ward beds and clinics, and served, on average, 1800 patients daily. Because it is a Catholic hospital, the institution not only serves the public with high technology ("high tech"), but also offers patients and staff the assistance of it Pastoral Care Department (PCD). This department is professionally staffed by 5 workers and 13 volunteers, all of whom strive to meet the spiritual needs of patients with a variety of religious dimensions which promote "high touch" care.

According to John Naisbit, patients are able to fully benefit from and embrace "high tech" when an outside, counterbalancing, and "high touch" response is also available. Naisbit describes "high touch" as an expression of human potential and a valuing of what is highly personal[1]. The author brings up the term "high touch" (in a general sense: "involving personal attention and service"[2]: https://dictionary.cambridge.org/dictionary/english/high-touch; retrieved 31 October 2023) as a terminus technicus in the pastoral care context. Used in healthcare, it describes emotional and personal aspects of care that are provided to patients. In pastoral care, "high touch" refers to the compassionate and empathetic care that is provided to patients, their families, and caregivers. It is a form of care that focuses on the spiritual, emotional, and psychological needs of

patients, rather than just their physical needs. Pastoral care providers are trained to provide this type of work in hospitals, hospices, and other healthcare settings needs of patients.

Those who practice medicine are discovering a need to use "high touch" to create an important balance in their approach to and treatment of patients.

Spiritual needs are numerous, and include a search for nature, a grasp of the purpose of being alive, and the meaning of an individual's life. The spiritual dimension is not limited to merely the domain of religion. Spiritual values overlap and welcome so called "non-religious" concerns. Technology is playing an ever increasing role in the providing of healing and care for patients. Evidence exists, however, that in the use of various forms of high technology, the valuing of the spiritual needs of patients, and an appreciation for holistic care may be overlooked or even completely neglected.

It is important to escalate an understanding of the value of “high touch" in medicine, which is based on the shared relationship between patients and physicians, who relate with one another and behave in a manner that reflects their beliefs. These could be beliefs based on ancient wisdom, or on the conclusions of science. Science does not always prosper in the mind of the patient[3].

This paper emphasizes that a Catholic hospital needs to promote its values in the practice of medicine that appreciates “high touch" as much as it appreciates advancement in the use of “high technology."

MATERIALS AND METHODS

The main goal of this research was to examine the spiritual needs of patients, and their response to “high technology” during their time of medical treatment.

From March 1 to September 30 2019, a total number of 5850 patients were admitted to Fu Jen Catholic University Hospital. Of that number, 2450 patients were visited by Pastoral Care Workers (PCW). Written evaluation protocols were submitted for 1515 patients (Figure 1). The evaluation of the patients was done by the five-step process of the Chinese Version of Spiritual Interests Related Illness Tool (C-SpIRIT): (1) Related to beliefs/religion (2) Positive attitudes toward life (3) Love to/from others (4) Seeking the meaning of life (5) Peaceful mind[4](Table 1).

Respondents to the questionnaires categorized spiritual needs in several ways: family support, emotional support, religious needs, need for connection/loneliness/depression, need to talk, plan for the future, solitude, and thoughts about the meaning of life. The written evaluation was placed in the medical records, and discussed and shared with the medical care team.

RESULTS

The results of the written evaluations of the patients were analyzed. Of the original 1515 written evaluations, 60% of the patients visited were found to be in some form of spiritual distress that required accompaniment in the form of compassion offered to them, active listening, and the sharing of life experiences.

The results of the study showed that individuals visiting health care facilities are viewed as suffering in situations of distress, and viewed in the context of a “disease that needs to be fixed” quickly and cheaply. Patients are not primarily regarded as human beings with complex needs, including those of a spiritual nature. 80% of the patients felt overwhelmed by the wide use of tests, technology, and pharmaceuticals offered to them as “fixes.” Patients were not particularly encouraged to take their medical conditions as an opportunity to find their own inner resources of health and healing. The spiritual needs of patients in terms of seeking meaning in life, a peaceful mind, and positive attitudes towards life, would appear to improve, therefore, if the medical team had a deeper understanding and appreciation for self-recognized spiritual growth, as well as the amount of good that cannot be done without “high touch” care. Although a sense of "human touch" may be difficult to quantify, we believe it has a clear and positive effect on the outcomes of efforts to heal illness and comfort patients.

In sum, patients in the hospital do not experience the care and compassion that relieves the burdens, and stress of illness—care they desire.

DISCUSSION

Technology has dramatically increased our human ability to meet the physical needs of patients. Technology obviously plays an important part in medical treatment. In the context of “personal medicine," this high touch interpersonal approach, which is related to the value of compassion, is “the value” that many patients seek and consider as medical care that is both effective and healing. Technology, however, cannot produce compassion. Compassion is an attitude, a way of approaching the needs of others, and of helping others in experiences of suffering[5]. But more importantly, compassion is a spiritual practice, a way of being, a way of service to others,

and an act of love.

The research showed that 80% of patients expressed that during the time of their illness they were seeking for the meaning of life. These persons experienced spiritual distress and existential crisis when they had been unable to find sources of meaning, hope, love, peace, comfort, strength and connection in life or when conflicts occur between their beliefs and what was happening in their lives. Thus, for those patients' spiritual assessment and care should be done during a medical encounter as a practical way to begin combining spirituality with medical practice.

It is important that doctors maintain a balanced, open-minded, and "high-touch" approach to medical care without sacrificing scientific integrity as "best practices" or rules of professional practice. Doctors can begin to integrate spirituality into medical practice in three ways: (1) by scientific study of the subject; (2) by assessment of the patient's spirituality and diagnosis of spiritual distress; and (3) by therapeutic interventions.

Sharing patients' spiritual needs with the medical team helps to enable patients to recognize their own a sense of personal spirituality, including the meaning of transcendence, and the purpose of life. Spiritual growth of the person cannot occur without an experience of so-called "high touch," which recognizes the great human need to interact with another human. We must be aware that caring for the health and well-being of our fellow humans has always been understood as a combination of art and science.

With all the recent advances in technology, there is no doubt the health care industry as a whole gets an "A" in science. We've become so focused on using technology that we spend far less time listening to individual human stories.

Health care is not simply a response to illness or disease. It is a holistic, lifelong engagement with the meaning of life. In the business of medical care, patients are becoming more aware of their need for holistic care[7]. Research has shown that many patients no longer tolerate high-tech, no-touch health care, and want the best of both worlds— "high-tech" and "high-touch" care. Similarly, as Paul Cerrato and John Halamaka argue, the field of medicine must re-think and re-imagine the ways it is practiced in the 21st century so that improved outcomes for good health, enhanced by high technology, can continue to transform our world[8]. It is all too easy for medical workers to fall into that trap that says technology can solve all the problems and meet the needs of our patients.

In the medical setting spirituality continues to be an unwelcome stepchild, and patients suffer from this short sighted point of view. For example, one meta-analysis that included over 32,000 adults with cancer found that spirituality was valued over physical health. This was so even when important socioeconomic and clinical variables were factored in[9]. It is therefore necessary to collect other data related to the holistic care of the spiritual needs of patients. Physicians and staff need to coordinate efforts, and share information that is useful for a broad and genuinely comprehensive understanding of the physical and psychological symptoms of patients. Physicians need to collect a great quantity of clinical data about the environmental conditions, psychological and behavioral patterns, and cultural beliefs and practices that patients express through their appearance and symptoms. These social, mental, and spiritual considerations can be key etiologic factors in medical conditions[10]. This all requires "high touch" skills and sensibilities.

It is already known that "high-touch" care can help build the physician—patient relationship, and this in turn is often associated with greater trust. Trust in healthcare relationships is a key element of effective and high-quality care[11]. The direct influence of trust on healthcare outcomes has long been acknowledged, and been proven to improve conduct change and medication adherence.

CONCLUSION

This paper has observed that all patients expect to be treated in a hospital with the most technologically advanced equipment, and most up to date methods of care. The quality of hospitals matters. Patients believe their doctors want for them to receive care from the very best of facilities. However, patients want more than the best equipment and most impressive technology. The bottom line is that "quick fix technology" amounts to nothing, if not accompanied by the "human touch." This holds true for all forms of healthcare.

"High tech" in therapeutic interventions should include concern of a patient's spirituality in recommendations regarding prevention, medical treatment and adjuvant care. Those elements of general spiritual care should be incorporated into the daily medical encounter and make the daily connection with the pastoral care workers. Though not easily measurable, but the author believes that physicians have skills to offer connection, compassion, and presence that can be a powerful therapeutic intervention called "high touch".

On a daily basis, and at the ground level,

similar to what happens at hospitals and other centers for healthcare that offer the highest quality of service, the key concern is to spend time caring for and healing patients. After all, patients desire an experience of healing which can truly help them cope with their health problems, which in many ways change their lives and shape their future. Evidence strongly suggests that despite the many benefits of high technology, hospitals fail to meet and satisfy the spiritual needs of patients. The creation of a "high touch" approach to care, and a personal experience of healing that promotes the harmony of mind, body, and spirit in each patient is necessary. No technology can take the place of human interaction, which in many ways is promoted by PCW. Hospitals should seriously consider their contributions, and recognize them.

At the same time, as increasing numbers of workers in the medical field become convinced we cannot escape from the technology that surrounds us, we appear to be living in times when "high tech" is in direct opposition to "high touch." It is also more common now than ever in our daily lives not to desire disruption simply for the sake of disruption, but rather to view scientific and technological advancement through a "human lens"[12]. In this way, we can continue efforts to improve patient care, and make it more accessible exactly where it matters – in the here and now.

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TABLE

Table 1 The five- step process the Chinese Version of Spiritual Interests Related Illness Tool (C-SpIRIT):

Item	Number of patients	Valid responses %
Related to beliefs/religion	1320	87.1
Positive attitudes toward life	1050	69.3
Love to/from others	1102	72.7
Seeking the meaning of life	1212	80
Peaceful mind	1115	73.6

FIGURE AND FIGURE LEGEND

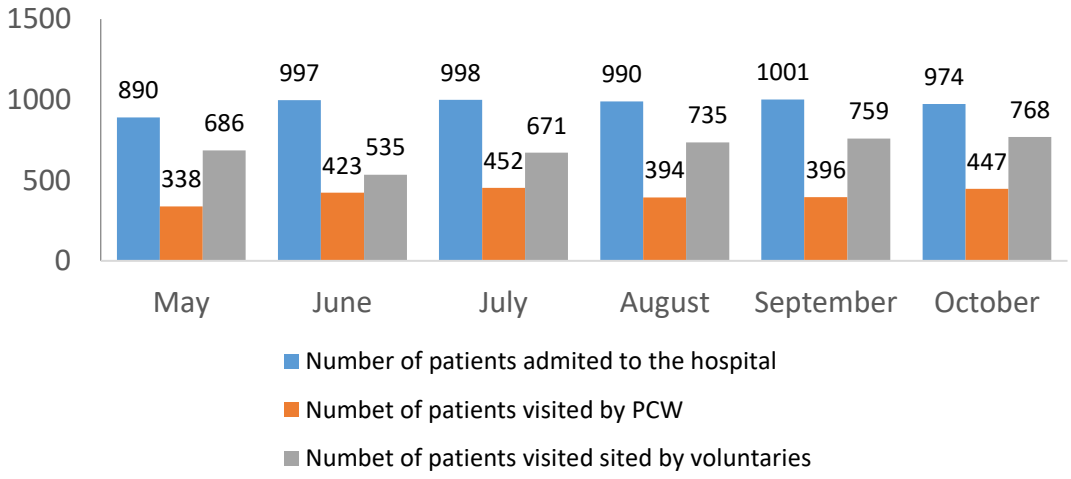

Figure 1. Chart of hospitalized patients and visits by PCW and volunteers

Hospital pastoral care service: promotion of "High Touch"

醫院牧關懷服務：推動 ”個人化接觸”

石台華 [1,*]

中文摘要

作者探討了醫療保健環境中“高科技”背景下”個人化接觸” (high touch) 的重要性。這一主題對於病人患病期間的日常體驗至關重要。醫療照顧不僅僅是對疾病或病症的回應，而是對生命整全意義的終生參與，病人越來越意識到自己需要整體性照護，研究顯示，僅靠“高科技”無法滿足精神需求，精神的危機日益凸顯在病人期間。病人不再容忍“高科技”與非接觸式醫療保健。他們想要兩全其美——“高科技”和 ”個人化接觸” (high touch) 的照護。那麼，問題是如何更好地應對未來發展的特殊挑戰和需求？“個人化接觸” (high touch) 如何在醫療保健領域採取必要的前進步驟？

關鍵字：個人化接觸、高科技、靈性上的需求、靈性上的危機

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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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