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Index

【Case Report】(in Japanese with Abstract in English)
A Case of Metabolic Syndrome with the Change of Ultrasonogram of the Pancreas
Nobuharu Ishigami

p 1-7

【Article】
Predictive validity of the Japanese version of Postpartum Depression Predictors Inventory-Revised (PDPI-R) during pregnancy and the postpartum period
Mikiyo Wakamatsu, Masayuki Nakamura, Motofumi Kasugai, Hiroshi Kimotsuki, Toshimichi Oki, Yuji Orita, Shinichi Togami, Hiroaki Kobayashi, Akira Sano, Tsutomu Douchi

p 9-19

鹿児島大学医学雑誌 第 68 巻　1-3 号　2016 年発行

目　　次

【症例報告】
膵超音波像が変化したメタボリックシンドロームの 1 症例
石神　信治

1-7 頁

【原著】（英文と日本語要約）
Postpartum Depression Predictors Inventory-Revised (PDPI-R) 日本語版による産後うつ病発生の予測に関する検討
若松　美貴代、中村　雅之、春日井　基文、肝付　洋、沖利　通、折田　有史、戸上　真一、小林　裕明、佐野　輝、堂地　勉

9-19 頁

鹿児島大学医学会
Med Soc Kagoshima Univ

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膵超音波像が変化したメタボリックシンドロームの１症例

石神信治

石神胃腸科内科医院

A Case of Metabolic Syndrome with the Change of Ultrasonogram of the Pancreas

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(Received 2015 Nov. 12; Revised (1st) Dec. 14; Revised (last) 2016, May 12; Accepted Jun. 13)

Abstract

To date there have been no clinical research reports clearly representing relationship between metabolic syndrome and chronic pancreatitis. Here I report a case of metabolic syndrome with ultrasonographic changes of the pancreas that may support this relation.

A 46-year-old female with complaint of vertigo visited my clinic in 2009. She was diagnosed as metabolic syndrome because of hypertriglyceridemia, hypertension and her waist circumference(95 cm).

When the patient visited my clinic because of epigastric pain, anorexia and constipation in 1993, hypercholesterolemia, hypo-HDL-cholesterolemia and the increase of the brightness of pancreas in ultrasonogram was detected. In 2011, a hypoechoic area with coarse hyperechoic dots in the head of the pancreas and no dilatation of the main pancreatic duct was observed ultrasonographically. The hypoechoic area disappeared nine months later. A spherical anechoic area (8.7×8.3 mm in size) in the head of the pancreas without dilatation of the main pancreatic duct in 2013 and a coarse hyperechoic dot at the papilla side of the anechoic area without tumor in 2014 were detected ultrasonographically. The anechoic area was diagnosed as a cystic lesion of the pancreas without evidence of malignancy by dynamic computed tomography.

Conclusion: The chronological observation of the patient has suggested that metabolic syndrome may be related to chronic pancreatitis.

Key words: metabolic syndrome, ultrasonogram, cystic lesion of the pancreas

はじめに

メタボリックシンドロームと慢性膵炎との関係は明らかになっていない[1]。筆者は以前メタボリックシンドローム症例の経過観察中に膵に粗大高エコーが出現した症例を報告し[2) 3)]、慢性膵炎との関係について考察した。今回、体外式腹部超音波検査（US）で膵の高輝度化を認めた後、膵超音波像が変化し、膵嚢胞が出現したメタボリックシンドロームの1例を経験したので報告し、メタボリックシンドロームと慢性膵炎との関係についてさらに考察した。

症例

患者：46歳、女性。

主訴：めまい

家族歴：特記することなし。

既往歴：特記することなし。

生活歴:飲酒歴なし。喫煙歴なし。動物性脂肪を好む。

現病歴：1993年12月、心窩部痛、食欲不振、便秘を訴えて当院受診した。body mass index (BMI）26.4kg/m^{2}の他胸腹部理学的所見に異常はなかった。空腹時検査成績で､総コレステロール（TC）255mg/dl､HDLコレステロール（HDL-C）38.8mg/dl、LDLコレステロール（LDL-C）196.2mg/dlであった。US（使用装置アロカSSD-630）では肝、胆、脾、腎に異常なく、膵の高輝度化を認めた（図1)。胃X線検査に異常はなかった。その後､来院しなかったが、めまいを訴えて2009年8月当院を受診した。

受診時現症：身長154cm、体重68.6kg、BMI 28.9kg/m^2、ウェスト周囲径95cm、血圧164/106mmHg。眼球結膜黄疸なし。眼瞼結膜貧血なし。胸部に著変なし。腹部は圧痛なく、肝、脾、腎および腫瘤を触知せず。

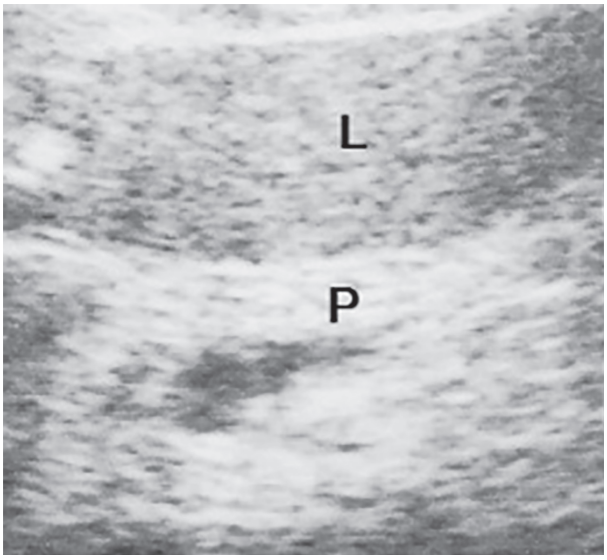


図1. 1993年12月の腹部超音波像：膵の高輝度化
（P: 膵蔵、L:肝臓）

空腹時検査成績：表1に示した。

臨床経過：経過中、2009年8月受診後は特記すべき自覚症状の訴えはなかった。1993年より2014年までの検査成績を表1に示した（2006年より2008年までは他施設での検診結果である)。2009年8月受診時ウェスト周囲径95cm、高トリグリセライド（TG）血症（483mg/dl)、低

年	1993	2006	2007	2008	2009	2010	2011	2012	2013	2014
月	12	10	8	8	8	7	10	7	11	5
AST（IU/l）	11	45	16	25	22	13	20	21	18	23
ALT（IU/l）	7	85	20	34	30	10	13	16	16	30
γ-GTP（IU/l）	14.7	68	39	71	56	25	14	18	32	
コリンエステラーゼ（IU/l）		405	389	399	449	334	307	313	375	
TG（mg/dl）	100	169	356	302	483	153	92	95	72	155
TC（mg/dl）	255	257	248	282	267	184	201	203	217	246
HDL-C（mg/dl）	38.8	38.7	34.2	42.6	34.9	38.4	46.8	43.1	45.9	50.4
LDL-C（mg/dl）	196.2	184.5	142.6	179	135.5	115	135.8	140.9	156.7	164.6
空腹時血糖（mg/dl）	106	118	106	106	96	92	96	96	92	99
血清アミラーゼ（IU/l）	83	59	55	63	57	71	64	58	70	
白血球数	7000	4800	6900	6200	4600	4900	3800	2800	4900	4200
赤血球数（×10^4）	432	413	401	416	427	374	376	358	392	391
血色素量（g/dl）	12.8	10.1	10	9.6	10.8	9.2	8.1	7.7	12.5	11.9
ヘマトクリット（%）		33.9	33.1	32.6	34.7	30.6	26.8	25.7	36.1	36.8
血小板数（×10^4/μl）		26.3	26.5	31.1	27.1	34.2	36.2	42	26.9	31.7

TG：トリグリセライド　TC：総コレステロール　HDL-C：HDLコレステロール　LDL-C：LDLコレステロール
LDL-C=TC−HDL-C−TG/5

表1.　検査成績の推移

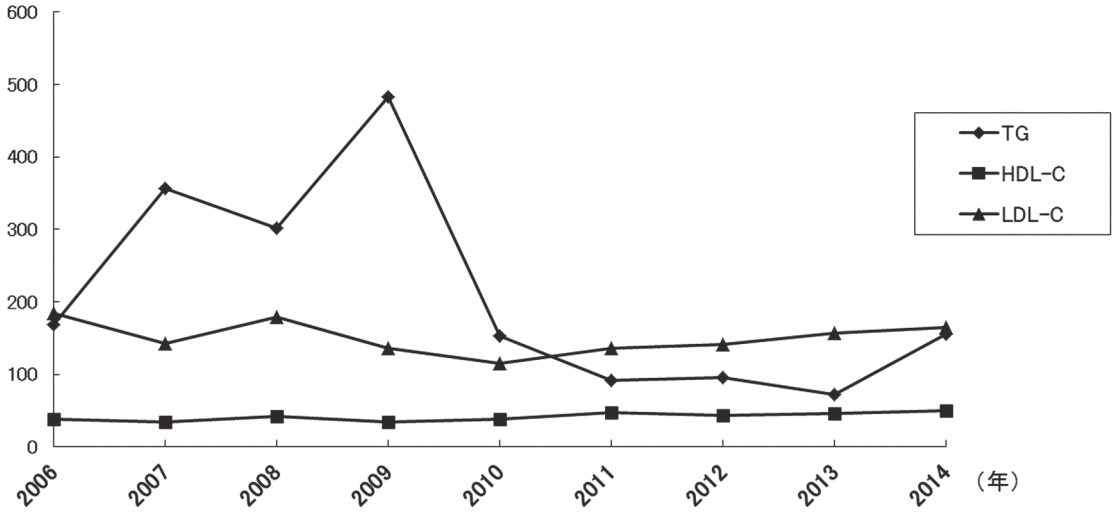


図2　TG , HDL-C , LDL-C の推移

HDL-C血症（34.9mg/dl）、高血圧（164/106mmHg）を認めたため、メタボリックシンドロームの診断基準[4] に基づきメタボリックシンドロームと診断し、高脂血症に対しベザフィブラート400mg/日、高血圧に対しカプトプリル18.75mg/日投与を開始した。2010年 1 月の血圧測定で160/94mmHgと依然高かったため、降圧剤をカプトプリル37.5mg/日、アムロジピン 5 mg/日の併用に切り換えた。2010年 7 月には血圧150/86mmHg、TG 153mg/dl、TC 184mg/dl、LDL-C 115mg/dlと改善し、2011年10月血圧は160/88mmHgと依然高かったが、TG、TC、HDL-C、LDL-C いずれも正常値にコントロールされた。しかし、2012年、2013年、2014年とLDL-Cが再び高値を示すようになった。現在、2010年の処方を継続するとともに食事指導を行いながら経過観察中である。2006年より2014年までのTG、HDL-C、LDL-Cの推移を図 2 に示す。なお、2006年より2012年まで続いた血色素量の低値については、2012年 7 月の血清鉄31 μ g/dlと低値であったので鉄欠乏性貧血と診断し、鉄剤投与を行い2013年には正常値となった。2013年11月、2014年 5 月のCA 19-9は正常値であった。

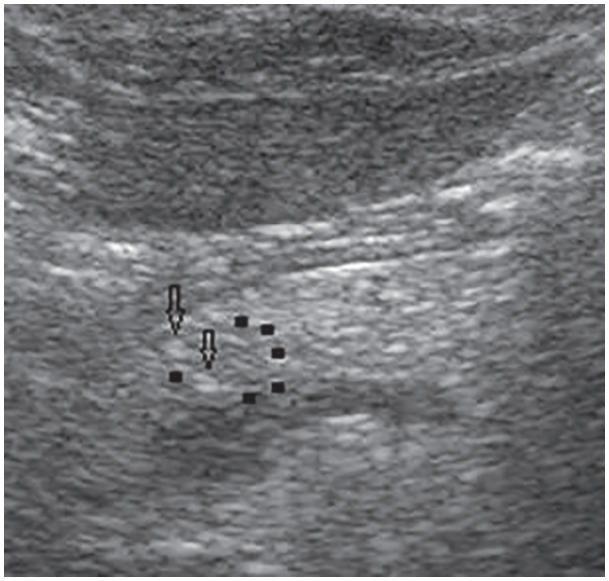
膵超音波像（使用装置東芝famio5 SSA-510A）：2011年10月、膵頭部に3.8mmの粗大高エコーを伴う部分的な低エコー域を認めた。主膵管の拡張は認めなかった（図3-a)。2012年 7 月、前回USの膵頭部低エコー域は消失した（図 3 -b)。2013年11月、膵頭部に8.7×8.3mmの球状の無エコー域を認めた(図 3 -c)。2014年 5 月､無エコー域の乳頭側に 5 mmの粗大高エコーを認めた（図 3 -d)。

ダイナミックコンピュータ断層撮影（ダイナミックCT）：2014年 7 月に施行した。超音波検査で認めた膵頭部の無エコー域は 9 mm大の嚢胞性病変と診断された。主膵管の有意な拡張は認めなかった（図 4)。積極的に悪性を疑う所見は指摘されず、膵管内乳頭粘液性腫瘍（IPMN）や貯留嚢胞の可能性があるとされた。MRCP（MR cholangiopancreatography)、EUS（内視鏡的超音波検査)、ERCP（内視鏡的逆行性胆膵管造影）等他の検査は患者の了承が得られず施行できなかった。

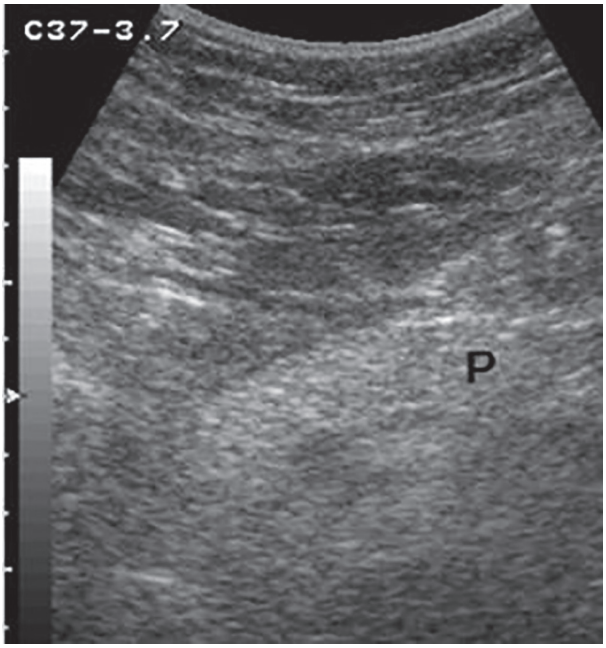
考察

本症例は1993年12月の膵超音波像で膵の高輝度化を認めた。牧野らは、腹部エコー検査において膵echogenicity上昇群と低下～正常群を比較したところBMI、HOMA-IR（homeostasis model assessment-insulin resistance）において有意差を認め、一般住民健診における膵echogenicity上昇所見はメタボリック症候群の各因子と関連が認められたと述べている[5]。本症例もBMI,26.4kg/m²と高く、膵高輝度化はBMIとの関連性が示唆された。

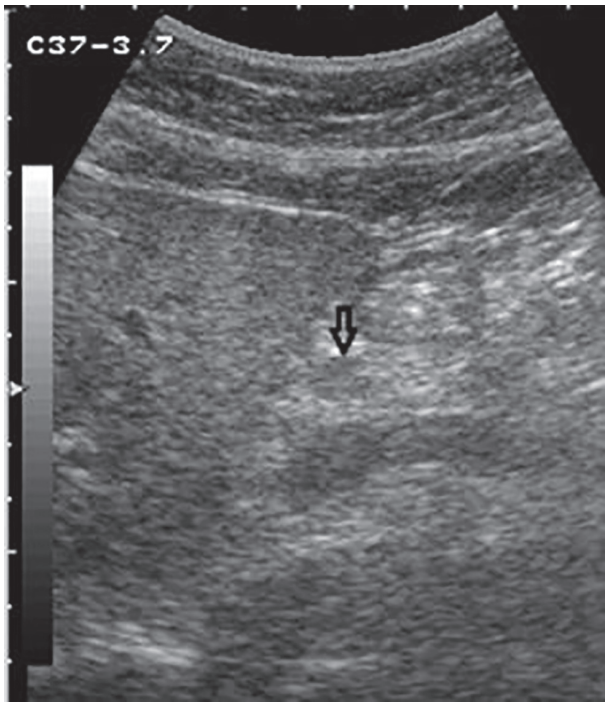
本症例は、初回USより18年後には膵輝度は減弱し、膵頭部に3.8mmの粗大高エコーを伴った部分的な低エコー域を認めた。石原らは、膵実質内部像の病的所見として点状型、斑状型、局所低エコー型があるとした上で、点状型は粗大な点状高エコーが散在するもので、径 3 mm以上のものは膵石とみなすことができると述べている[6]。本症例の粗大高エコーは新たな慢性膵炎臨床診断基準2009[7] の準確診所見である「USにおいて、膵内の結石または蛋白栓と思われる高エコー」にあたると考えられ、膵石の可能性があると推測した。木本らは全



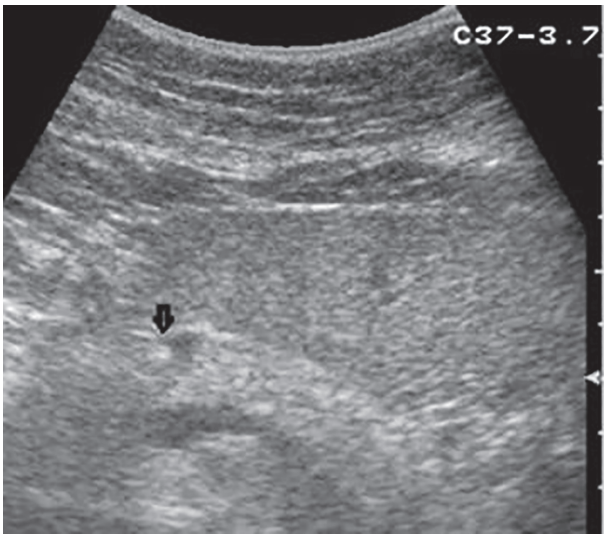
a



b



c



d

図3

a: 2011年10月の腹部超音波像：膵頭部に3.8mmの粗大高エコー（矢印）を伴う部分的な低エコー域（・印で囲んだ部分）を認めた。主膵管の拡張は認めなかった。

b: 2012年7月の腹部超音波像：2011年10月にみられた低エコー域は消失した。（P：膵）

c: 2013年11月の腹部超音波像：膵頭部に8.7×8.3mmの球状の無エコー域（矢印）を認めた。主膵管拡張は認めなかった。

d: 2014年5月の腹部超音波像：無エコー域の乳頭側に5mmの粗大高エコー（矢印）を認めた。

摘、体尾部切除により得た慢性膵炎10例の術前超音波像ないしは水浸下超音波像と組織学的変化とを対比し、高度結合織増生はエコーレベル軽度低下を示したと述べている[8]。部分的な低エコー域は膵癌でも見られる。奥野らは、腫瘍径10mm以下膵癌 6 例について各画像検査における膵腫瘍検出感度、間接所見（主膵管拡張等）の検出感度、両者を合わせた検出感度を検討し、腹部USでは3/4：2/4：4/4（75％：50％：100％）であったとし、

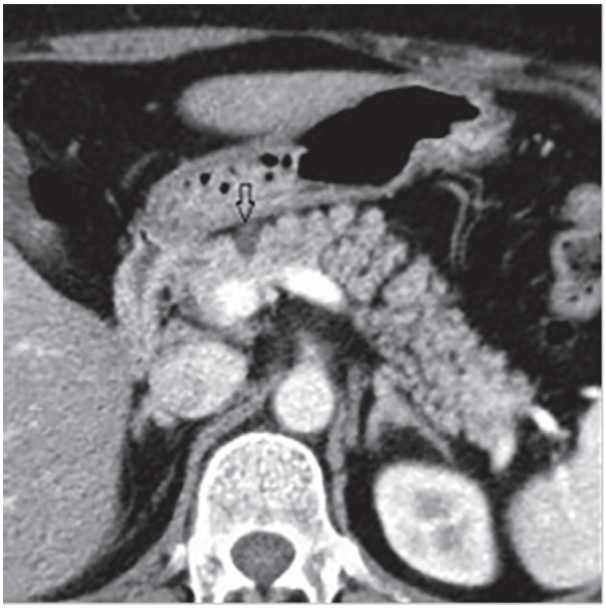


図4. 2014年7月のダイナミックCT像：矢印部にcystic lesionを認める。

腫瘍の描出が困難でも主膵管拡張が診断に結びついていると述べている[9]。本症例の部分的な低エコー域は主膵管拡張を認めず、粗大高エコーを伴っており、9 ヵ月後には消失したことから慢性膵炎の部分的な結合織増生によるものであった可能性がある。

初回USより20年後にUSで膵頭部に球状の無エコー域を認め、その乳頭側に粗大高エコーを認めたが腫瘍性病変は確認できなかった。ダイナミックCTでは嚢胞性病変と診断され、積極的に悪性を疑う所見は指摘されず、IPMNや貯留嚢胞の可能性を指摘された。膵嚢胞は膵に発生する嚢胞性疾患の総称で、多彩な病態が含まれる。嚢胞と正常膵との境界には被膜・隔壁が存在し、裏打ちする内腔上皮の有無により仮性嚢胞と真性嚢胞に分類される。真性嚢胞は先天性、後天性に大きく分けられ、後天性嚢胞は腫瘍性嚢胞と非腫瘍性嚢胞に分類される。後天性非腫瘍性嚢胞には貯留嚢胞、寄生虫性嚢胞などがある[10]。山雄らは、嚢胞の数は、腫瘍性嚢胞は基本的には単発例が多い、炎症性嚢胞は単発、多発いずれも起こりうる、嚢胞全体の形状では、貯留嚢胞、粘液性嚢胞腺腫や嚢胞腺癌などは球状、背景病変の存在診断では、膵嚢胞には慢性膵炎や膵癌などの基礎疾患を有している症例が存在し、嚢胞自体の性状から鑑別診断が困難な場合には、背景病変の把握、すなわち嚢胞の周囲の膵実質や乳頭側の膵臓の状態をUSやEUSで詳細に観察する必要があると述べている[11]。中迫らの膵嚢胞性病変とその最大径との関係の検討では、仮性嚢胞の35例中27例（77％）、貯留嚢胞の18例中 9 例（50％）、腺腫、腺癌といった腫瘍性病変の25例中23例（92％）が 3 cm以上であった。3 cm未満の腫瘍性病変は 2 例（8％）で、すべて腺腫であり、1 cm以下の症例では仮性嚢胞 1 例、貯留嚢胞 2 例であったと報告している[12]。本症例に出現した膵嚢胞は、球状、1 cm以下で嚢胞の乳頭側に腫瘍を認めず、膵管拡張も認められなかった。また、嚢胞周辺に粗大高エコーを認めた。これらのことから慢性膵炎の部分的増悪と関係した貯留嚢胞の可能性が考えられた。

本症例は2009年受診時（初回USより16年目）に診断されたメタボリックシンドロームが、膵の線維化に関与したのではないかと推察した。Matsudaらは、Zucker diabetic fatty（ZDF）ラットに慢性的に高脂肪食を与え、標準食群と比較した。その結果、高脂肪食を与えたZDFラット（FH群）は、12週齢と18週齢で外分泌腺領域の脂肪蓄積割合が標準食群に比べ有意に高く、24週齢で減少した。また、FH群は18週齢で腺房細胞内に脂肪小滴が観察されたが、その後24週齢までに減少した。さらに、FH群では24週齢で標準食群に比べ膵線維化領域の割合が増加したと報告している[13]。寺本は、メタボリックシンドロームにおける脂質異常はインスリン抵抗性を基盤とする高TG血症であり、small dense LDL、レムナント、食後高脂血症の出現などがあるとしており、small dense LDLの問題点は、サイズが小さいために動脈壁に進入しやすいということと、酸化を受けやすいということであり、酸化LDLは内皮細胞障害をもたらし、動脈硬化発症の初期病変を形成する可能性が示唆されると述べている[14]。前田は糖尿病患者について、酸化LDLの高い群（≧25.6U/ml）12例と低い群（≦4.5U/ml）16例の内皮細胞機能の指標である血流依存性血管拡張反応（flow-mediated endotherial vasodilation; FMD）を検討し、酸化LDLが高い群2.2±2.2％、低い群で5.1±3.2％と酸化LDLが高い群で内皮機能が障害されていることを確認した。また、FMDを規定している要因を検討したところ、％FMDは血清LDL-C濃度と有意の負の相関を示していたと述べている[15]。YanらによるとWistarラットで作成した高脂血症モデルラットの膵血流速度はコントロール群に比べ15.39％減少、H＆E染色した組織片で膵腺房細胞、膵島細胞の空胞化、膵腺房細胞の萎縮、まばらな小葉間、小葉内線維化等を認め、電子顕微鏡で血管内皮細胞が狭窄した血管内腔への異常な突出を示し、いくつかの内皮細胞が不連続であった。さらにα-smooth muscle actin（α-SMA）陽性細胞の増加およびα-SMA mRNA発現量の増加等が認められた[16]。Zhangらは、Sprague-Dawleyラットを用い、高脂肪食を与えた群とコントロール群の膵組織と血清アミラーゼ、トリグリセライド（TG）を調べ、アミラーゼは高脂血症で導かれた膵傷害のバイオマーカーとして有用であると述べている[17]。Siechらは、

Wistarラットから膵腺房細胞（PAC）、膵星細胞（PSC）を単離し、エタノールか脂肪（VLDL）あるいは両者の組合せが膵腺房細胞傷害に導くかどうか調べた。その結果、50 μ g/ml VLDL単独では 2 時間以内にLDH、アミラーゼ、リパーゼ活性が増加した。次に培養したPACの上清がPSC増殖とマトリックス合成を刺激するかどうか調べた。その結果、VLDL単独で処理したPACの上清では星細胞は適度に増殖し、PSCに関係した細胞外マトリックス合成についてはVLDL単独で処理したPAC上清はコントロール群やアルコール単独群に比べ量が多かったと述べている[18]。これらのことから、高脂血症例では膵傷害が起こり、膵線維化が出現する症例があることが考えられる。本症例は、1993年以降表 1 に示すように高TC血症、高LDL-C血症、高TG血症、低HDL-C血症等脂質代謝異常が続いたことから、本症例におけるUS像の変化は膵傷害により膵線維化が進行したことを示していると考える。

まとめ

本症例は当初膵の高輝度化を認め、その後膵頭部に粗大高エコーを伴う部分的な低エコー域を認めたため慢性膵炎を疑い経過観察を行っていた。その経過観察中に膵頭部に8.7×8.3mmの球状の膵嚢胞が出現した。この膵嚢胞はUSでの経過観察の結果、形、大きさに変化なく、膵嚢胞の乳頭側には粗大高エコーを認めた。また膵嚢胞の乳頭側には腫瘍性病変は認めず、膵管拡張も認められなかった。このような経過から、本症例にみられた膵嚢胞は、慢性膵炎の部分的増悪と関係した貯留嚢胞であると考えた。メタボリックシンドローム症例については経過観察によりUSで膵に粗大高エコー、膵嚢胞、膵腫瘤、膵管拡張等慢性膵炎にまつわる所見が出現していないかどうか詳細に検索する必要があると考える。本症例の検討からメタボリックシンドロームと慢性膵炎とは関係がある可能性が示唆された。

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Predictive validity of the Japanese version of Postpartum Depression Predictors Inventory-Revised (PDPI-R) during pregnancy and the postpartum period

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Abstract

Aim: To identify the risk factors for postpartum depression (PPD) during pregnancy and the early postpartum period is considered important for preventing the development of PPD. Postpartum Depression Predictors Inventory-Revised (PDPI-R, self-report questionnaires) was developed from Beck's updated meta-analysis and correlated with the development of PPD. The purpose of the present study was to investigate the predictive validity of the Japanese version of PDPI-R during pregnancy and one month after delivery.

Materials and methods: Pregnant Japanese women (n=192) participated in this study between December 2012 and February 2015 at the Department of Obstetrics and Gynecology, Kagoshima University Hospital and three practitioners in Kagoshima prefecture, all of which are located in the southern part of Japan. Subjects were 120 pregnant Japanese women who completed PDPI-R during 10-23 weeks of gestation and one month postpartum. All subjects delivered full-term healthy babies. PPD symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS) one month after delivery. The predictive validity of the Japanese version of PDPI-R was investigated. After identifying appropriate cut-off values by carrying out a receiver operating characteristic (ROC) curve, sensitivity, specificity, positive and negative predictive values, and the accuracy of PDPI-R were determined in both versions.

Results: Twelve (10%) out of 120 mothers met the PPD criteria with EPDS scores of 9 or higher. With a prenatal cut-off value of

7.0 after carrying out a ROC curve, the sensitivity and specificity of PDPI-R were 50.0% (6/12) and 87.0% (94/108), respectively. The positive and negative predictive values of PDPI-R were 30.0% (6/20) and 94.0% (94/100), respectively. The cut-off value of 7.0 was superior to 6.0 and 8.0. With a postpartum appropriate cut-off value of 8.0, sensitivity and specificity were 66.7% (8/12) and 88.0% (95/108), respectively. The positive and negative predictive values were 38.1% (8/21) and 96.0% (95/99), respectively. The cut-off value of 8.0 was superior to 7.0 and 9.0.

Conclusions: The Japanese version of PDPI-R is a useful instrument for predicting PPD in not only the postpartum period, but also the prenatal period. An appropriate cut-off value of PDPI-R may be 7.0 in the prenatal version and 8.0 in the postpartum version.

Key words: cut-off value, Edinburgh Postnatal Depression Scale, Japanese version, Postpartum Depression, Postpartum Depression Predictors Inventory-Revised, risk factor, sensitivity, specificity

Introduction

Postpartum depression (PPD) is a global phenomenon that has been reported in 10-15% of mothers in Western countries.[1), 2)] Suicides were previously shown to account for up to 20% of deaths during the postpartum period.[3)] PPD has been implicated in a number of these tragic cases. It has also been shown to affect a partner's mental health and child's socio-psychiatric development,[2, 4)] and has been associated with child neglect and abuse.[5, 6)] Although every pregnant woman is at risk of developing PPD, those with specific risk factors may be at a higher risk of developing PPD.[2, 7)] Thus, identifying the risk factors for PPD during pregnancy and the early postpartum period is considered important for preventing the development of PPD. Postpartum Depression Predictors Inventory-Revised (PDPI-R, self-report questionnaires) was developed from Beck's updated meta-analysis[8)] and correlated with the development of PPD.[9-11)] Compared with PDPI-R, the other instrument developed by Webster *et al*. does not assess factors including socio-economic status, marital status, child care stress, life stress, and prenatal depression, and is only used in the postpartum period, not during pregnancy.[12)] In previous screening instruments summarized by Ikeda *et al*.[13)] and Beck *et al*.[8, 14)] several items adopted in PDPI-R were absent. PDPI-R has the advantage of being the only prenatal screening scale.[8, 14)] In Japan, there have been no prenatal instruments to predict PPD.

Therefore, the purpose of the present study was to investigate the clinical usefulness of the Japanese version of PDPI-R and determine its predictive validity during the prenatal and postpartum periods.

Materials and methods

Fully informed written consent was obtained from each pregnant woman. This study was conducted in accordance with the Institutional Review Board (No.288) at Kagoshima University Hospital and the Helsinki Declaration, 2013. The Japanese version of PDPI-R was used after obtaining permission from Beck CT. PDPI-R was translated from English into Japanese by psychiatrists and a midwife, then translated back into English by a bilingual doctor. The Japanese version of PDPI-R was completed in consensus.

Pregnant Japanese women (n=203) participated in this study between December 2012 and February 2015 at the Department of Obstetrics and Gynecology, Kagoshima University Hospital and three practitioners in Kagoshima prefecture, all of which are located in the southern part of Japan. Exclusion criteria included women who refused entry to this study (n=11), those who had a past history of medically-treated psychiatric disorders including (postpartum) depression (n=4), those who could not understand Japanese, (n=1) and those who dropped out (n=67). Drop out cases included premature delivery (n=3), intrauterine fetal death (n=1), and incomplete PDPI-R (n=63). Incomplete PDPI-R cases were almost all in postpartum women due to being busy with childcare. Thus, 120 women were enrolled in this study. All subjects completed PDPI-R (self-report questionnaires) during 10-23 weeks of gestation and one month postpartum. Gestational age at the first survey was 17.3 weeks (SD ＝ 4.2).

All subjects delivered full-term healthy babies. Baseline characteristics included age, gestational age, marital status, employment status, socio-economic status, and parity. PDPI-R during 10-23 weeks of gestation included 10 items: 1) marital status, 2) socio-economic status, 3) self-esteem, 4) prenatal depression, 5) prenatal anxiety,

6) unplanned/unwanted pregnancy, 7) history of previous depression, 8) social support, 9) marital dissatisfaction, and 10) life stress.

Total scores on the prenatal version of PDPI-R ranged from 0 to 32. Three additional items were included in the postpartum PDPI-R examination one month after delivery: 11) child care stress, 12) infant temperament, and 13) maternity blues. Total scores on the postpartum version ranged from 0 to 39. PPD symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS) [15] one month after delivery. Women with EPDS scores of 9 or higher were suspected of PPD in the Japanese criteria.[16-18]

Statistical analysis

Intra- and inter-group comparisons were performed by the McNemar test, Wilcoxon rank-sum test, and Mann-Whitney *U* test, as appropriate. Relationships between variables were assessed by the Spearman rank correlation test. A univariate logistic regression analysis was used to determine the odds ratio of 13 items in the development of PPD. The strength of the odds ratio was explained as a 95% confidence interval (CI). In this analysis, the independent variable was the presence or absence of PPD (non-PPD), while the dependent variables were the 13 items tested. The presence or absence of PPD was a nominal variable, and the presence of PPD was registered as 1, while its absence was registered as 0. After identifying appropriate cut-off values by carrying out a receiver operating characteristic (ROC) curve, sensitivity, specificity, positive and negative predictive values, and the accuracy of PDPI-R were determined in both versions. $P<0.05$ was considered significant. Statistical analyses were performed using SPSS, version 22 (IBM, Armonk, NY, USA).

Results

Twelve (10.0%) out of 120 mothers met the PPD criteria with EPDS scores of 9 or higher. Table 1 shows the baseline characteristics of the enrolled subjects (n=120). The percentages of primiparous and married women were 51.7%, and 89.2%, respectively. Only 2.5% of the women were single. A quarter of the women (24.2%) had a low socio-economic status. No significant differences were observed in the distribution of marital status, employment status, socio-economic status and parity between the two groups. Mean age was 30.1 years (SD=4.6).

Table 2 shows changes in risk factor scorings of PDPI-R during pregnancy and the postpartum period in all subjects. The low self-esteem variable was significantly different between the pregnancy and the postpartum periods ($p<0.05$). No significant differences were observed in the other 9 variables between the two time points. Table 3 shows the

Table 1 Baseline characteristics of enrolled subjects (n=120)

		n (%)	PPD	non-PPD	*p* (Fisher's exact test)
Marital status	Single	3 (2.5)	1	2	0.474
	Married	107 (89.2)	10	97	
	Separated	1 (0.8)	0	1	
	Partnered	9 (7.5)	1	8	
Employment status	Housewife	48 (40.0)	3	45	0.593
	Employed	53 (44.1)	7	46	
	Part-time	17 (14.2)	2	15	
	Self-employed	2 (1.7)	0	2	
Socio-economic status	Low	29 (24.2)	4	25	0.304
	Medium	90 (75.0)	8	82	
	High	1 (0.8)	0	1	
Parity	0	62 (51.7)	7	55	0.450
	1	45 (37.5)	3	42	
	2	11 (9.2)	1	10	
	3	2 (1.7)	1	1	

Table 2 Changes in risk factor scorings of PDPI-R during pregnancy and the postpartum period (n=120)

	Range		Median (range) † / Number (%)		*p* (McNemar Wilcoxon)
			During pregnancy	One month postpartum	
Prenatal variables					
F1 Being single	0-1		3 (2.5)	1 (0.8)	0.625
F2 Low socio-economic status	0-1		29 (24.2)	25 (20.8)	0.523
F3 Low self-esteem ǂ	0-3	1	23 (19.2)	27 (22.5)	0.018*
		2	24 (20.0)	15 (12.5)	
		3	7 (5.8)	5 (4.2)	
F4 Perinatal depression	0-1		12 (10.0)	19 (15.8)	0.167
F5 Prenatal anxiety	0-1		74 (61.7)	71 (59.2)	0.749
F6 Pregnancy intendedness §	0-2	1	41 (34.2)	41 (34.2)	0.987
		2	2 (1.7)	2 (1.7)	
F7 Prior depression	0-1		10 (8.3)	11 (9.2)	0.705
F8 Lack of social support //	0-12		0 (0-8) †	0 (0-7) †	0.228
F9 Marital dissatisfaction ¶	0-3	1	18 (15.0)	18 (15.0)	0.859
		2	2 (1.7)	5 (4.2)	
		3	2 (1.7)		
F10 Life stress **	0-7		0 (0-3) †	0 (0-4) †	0.800
Postpartum variables					
F11 Child care stress ††	0-3	1		28 (23.3)	
		2		8 (6.7)	
F12 Infant temperament §§	0-3	1		52 (43.3)	
		2		22 (18.3)	
		3		3 (2.5)	
F13 Maternity blues	0-1			51 (42.5)	

* $p < 0.05$

ǂ Do you feel good about yourself? Do you feel worthwhile? Do you have good qualities?

§ Was the pregnancy planned? Was the pregnancy unwanted?

// Do you believe that you receive adequate emotional support from your (partner/family/friends)?
Do you believe that you can confide in your (partner/family/friends)?
Do you believe that you can rely on your (partner/family/friends)?
Do you believe that you receive adequate instrumental support from your (partner/family/friends)?

¶ Are you satisfied with your marriage or living arrangement?
Are you currently experiencing any marital relationship problems?
Are things going well between you and your partner?

** Are you currently experiencing any stressful events in your life such as (financial problems/marital problems/death in family/unemployment/serious illness in family/moving/job change)?

†† Is the infant experiencing any health problems?
Are you having problems feeding the baby?
Are you having problems with the baby sleeping?

§§ Would you consider the baby irritable?
Does the baby cry a lot?
Is your baby difficult to console or soothe?

Table 3 Distribution of Postpartum Depression cases at two time points during pregnancy

	Gestational age 10-16 weeks n (%)	Gestational age 17-23 weeks n (%)	*P* (Chi-square test)
PPD	4 (7.7)	8 (11.8)	0.461
non-PPD	48 (92.3)	60 (88.2)	

Table 4 Total PDPI-R scores in PPD and non-PPD women at two time points

	PPD (n=12)			non-PPD (n=108)			*p*
	med.	min.	max.	med.	min.	max.	(Mann-Whitney *U* test)
Prenatal version	6.50	2	16	3.00	0	13	< 0.05
Postpartum version	8.00	3	17	4.00	0	17	< 0.001

Table 5 Odds ratio of PDPI-R variables in the development of PPD

	During pregnancy		One month postpartum	
	Odds Ratio	95% Cl	Odds Ratio	95% Cl
Prenatal version				
F1 Being single	4.82	0.40 - 57.50	NA	NA
F2 Low socio-economic status	1.58	0.44 - 5.66	2.07	0.57 - 7.54
F3 Low self-esteem	1.67	0.95 - 2.95	2.92	1.56 - 5.45†
F4 Prenatal depression	1.96	0.38 - 10.22	5.22	1.44 - 18.88*
F5 Prenatal anxiety	3.18	0.66 - 15.24	3.85	0.81 - 18.43
F6 Pregnancy intendedness	0.84	0.25 - 2.76	1.62	0.55 - 4.76
F7 Prior depression	1.14	0.13 - 9.95	1.00	0.12 - 8.65
F8 Lack of social support	1.29	0.99 - 1.69	1.43	1.08 - 1.89*
F9 Marital dissatisfaction	2.26	1.04 - 4.90*	2.30	0.93 - 5.67
F10 Life stress	1.50	0.70 - 3.19	1.58	0.88 - 2.83
Postpartum version				
F11 Child care stress			2.10	0.91 - 4.84
F12 Infant temperament			1.87	0.91 - 3.86
F13 Maternity blues			4.71	1.21 - 18.42*

* $p < 0.05$

† $p < 0.01$

CI = confidence interval

NA = not available

Table 6 Spearman rank correlation test between variables in the prenatal version (n=120)

	Total score	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Total score	1										
F3 Self-esteem	0.567†	ns	ns	1							
F4 Prenatal depression	0.128	—	—	ns	1						
F5 Prenatal anxiety	0.279†	—	—	ns	—	1					
F6 Unplanned/unwanted pregnancy	0.294†	0.208*	ns	ns	ns	ns	1				
F7 History of previous depression	-0.047	—	—	ns	—	—	ns	1			
F8 Social support	0.717†	ns	ns	0.228*	ns	ns	ns	ns	1		
F9 Marital dissatisfaction	0.432†	0.190*	ns	0.201*	0.188*	ns	ns	ns	0.307†	1	
F10 Life stress	0.391†	ns	0.191*	ns	ns	ns	ns	ns	0.250†	0.271†	1

* $p < 0.05$

† $p < 0.01$

ns = not significant

distribution of the postpartum depression casas at two time points during pregnacy. The distribution of PPD was not significantly different between the two time points. Table 4 shows total PDPI-R scores in PPD (n=12) and non-PPD women (n=108) at the two time points. In the prenatal PDPI-R version, median scores were higher in PPD than in non-PPD women. In the postpartum version, median scores were also higher in non-PPD women. Median scores were higher in the postpartum version than in the prenatal version in both groups. The spearman rank correlation test between total PDPI-R scores at two time points. The prenatal version was positively correlated with the postpartum version (r=0.394, $p<0.001$).

Table 5 shows the odds ratio of PDPI-R items in the development of PPD from a univariate logistic regression analysis. In the prenatal version, marital dissatisfaction was identified as a significant predictor of PPD (Odds ratio; 2.26, 95% CI; 1.04-4.90, $p<0.05$). In the postpartum version, low self-esteem (odds ratio; 2.92, 95% CI; 1.56-5.45, $p<0.01$), prenatal depression (5.22, 1.44-18.88, $p<0.05$), lack of social support (1.43, 1.08-1.89, $p<0.05$), and maternity blues (4.71; 1.21-18.42, $p<0.05$) showed significant high odds ratios. Tables 6 and 7 show the results of the Spearman rank correlation test between variables in the prenatal and postpartum versions. In the prenatal version, low self-esteem positively correlated with the lack of social support (r=0.228, $p<0.05$), marital dissatisfaction (0.201, $p<0.05$), and total scores (0.567, $p<0.01$) (Table 6). In the postpartum version, prenatal depression was positively correlated with marital dissatisfaction (0.251, $p<0.01$), and total PDPI-R scores (0.309, $p<0.01$) (Table 7). Maternity blues positively correlated with infant temperament (0.204, $p<0.05$) and total scores (0.289, $p<0.01$).

After carrying out a ROC curve, appropriate cut-off values were identified as 7.0 in the prenatal version and 8.0 in the postpartum version. Table 8 shows the sensitivity, specificity, positive and negative predictive values, and accuracy in appropriate and nearly appropriate cut-off values in the two versions. With a prenatal cut-off value of 7.0, sensitivity and specificity were 50.0% (6/12) and 87.0% (94/108), respectively. The prenatal cut-off value of 7.0 was superior to 6.0 and 8.0. The positive and negative predictive values of PDPI-R during pregnancy were 30.0% (6/20) and 94.0% (94/100) at a cut-off value of 7.0, respectively. The positive predictive cut-off value of 7.0 was superior to 6.0 and 8.0. In the postpartum version, sensitivity and specificity were 66.7% (8/12) and 88.8% (95/108), respectively, with a cut-off value of 8.0. The postpartum cut-off value of 8.0 was superior to 7.0 and 9.0. The positive and negative predictive values were 38.1% (8/21) and 96.0% (95/99), respectively. The positive predictive cut-off value of 8.0 was superior to 7.0 and 9.0. In addition the postpartum version was superior to the prenatal version (38.1% and 30.0%, respectively.).

Discussion

The prevalence of PPD is suggested to vary with the mother's background including age, parity, educational level, socio-economic status, marital status, social support, culture, geography, and race.[7] It may also differ based on the number of women with a past history of depression and the cut-off value of EPDS.[13, 19-23] The cut-off value of EPDS is generally higher in Western countries[19, 21-23] than in Japan.[16-18] However, accumulating evidence has indicated that the prevalence of PPD is similar.[14, 16, 17, 24-26] In the present study, the prevalence of PPD determined based on EPDS scores of 9 or higher was 10.0%. This prevalence rate was not different from previous findings.[14, 17, 24, 25, 27, 28]

In the prenatal PDPI-R version, a history of depression, current depression/anxiety, and low level of partner support have been associated with the occurrence of PPD.[7] Current depression/anxiety may be amenable to change and, thus may be targeted for medical intervention.[7] In the present study, among the 10 variables tested, only marital dissatisfaction was identified as a significant predictor of PPD. This result was inconsistent with the findings of Milgrom *et al*.[7] Possible explanations for this discrepancy include differences in the number of enrolled subjects, subject backgrounds, screening instruments, and culture. In the present study, marital dissatisfaction was associated with prenatal depression and the lack of social support in a univariate regression analysis. Therefore, our results did not always disagree with those by Milgrom *et al*.

The postpartum period is characterized by increased susceptibility to different mood disorders of varying severity.[29] This is also supported by the results of the present study, which showed that the total PDPI-R score increased in the postpartum period in not only PPD, but also non-PPD women. Maternity blues has been reported in approximately 40-70% of postpartum women within a few days of delivery in Western countries.[30, 31] Although the etiology of maternity blues remains unclear, maternity blues and PPD are common complications in postpartum women. Previous studies have investigated the relationship between the severity of

Table 7 Spearman rank correlation test between variables in the postpartum version (n=120)

	Total score	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
Total score	1													
F3 Self-esteem	0.409†	ns	ns	1										
F4 Prenatal depression	0.309†	—	—	ns	1									
F5 Prenatal anxiety	0.193*	—	—	0.265†	—	1								
F6 Unplanned/unwanted pregnancy	0.389†	ns	0.277†	ns	ns	ns	1							
F7 History of previous depression	0.145	—	—	ns	—	—	ns	1						
F8 Social support	0.513†	ns	ns	0.265†	ns	ns	ns	ns	1					
F9 Marital dissatisfaction	0.270†	ns	ns	ns	0.251†	ns	ns	ns	0.251†	1				
F10 Life stress	0.466†	ns	0.330†	0.188*	ns	ns	ns	ns	0.200*	ns	1			
F11 Child care stress	0.405†	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	1		
F12 Infant temperament	0.458†	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.257†	1	
F13 Maternity blues	0.289†	—	—	ns	—	—	ns	—	ns	ns	ns	ns	0.204*	1

* $p < 0.05$
† $p < 0.01$
ns = not significant

Table 8 Sensitivity, specificity, positive and negative predictive values, accuracy of appropriate and nearly appropriate cut-off values in the two versions

Cut-off value	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Prenatal version of PDPI-R					
5.0	66.6% (8/12)	72.2% (78/108)	21.1% (8/38)	96.3% (78/81)	70.8%
6.0	58.3% (7/12)	81.5% (88/108)	25.9% (7/27)	94.6% (88/93)	79.1%
7.0	**50.0% (6/12)**	**87.0% (94/108)**	**30.0% (6/20)**	**94.0% (94/100)**	**83.3%**
8.0	33.3% (4/12)	89.8% (97/108)	26.7% (4/15)	92.4% (97/105)	84.1%
9.0	33.3% (4/12)	92.6% (100/108)	33.3% (4/12)	92.6% (100/108)	86.7%
10.0	8.3% (1/12)	95.4% (103/108)	16.7% (1/6)	90.4% (103/114)	86.7%
11.0	8.3% (1/12)	97.2% (105/108)	25.0% (1/4)	90.5% (105/116)	88.3%
Postpartum version of PDPI-R					
6.0	83.3% (10/12)	70.4% (76/108)	23.8% (10/42)	97.4% (76/78)	71.6%
7.0	75.0% (9/12)	80.6% (87/108)	30.0% (9/30)	96.7% (87/90)	80.0%
8.0	**66.7% (8/12)**	**88.0% (95/108)**	**38.1% (8/21)**	**96.0% (95/99)**	**85.8%**
9.0	41.7% (5/12)	88.9% (96/108)	29.4% (5/17)	93.2% (96/103)	84.2%
10.0	33.3% (4/12)	91.7% (99/108)	30.8% (4/13)	92.5% (99/107)	85.8%
11.0	33.3% (4/12)	93.5% (101/108)	36.4% (4/11)	92.7% (101/109)	87.5%
12.0	33.3% (4/12)	95.4% (103/108)	44.4% (4/9)	92.8% (103/111)	89.2%

maternity blues and the risk of PPD.[10, 11, 17, 20, 27, 30-34] In the postpartum version, we found that maternity blues was a significant predictor of PPD (odds ratio=4.71) as well as prenatal depression (5.22), low self-esteem (2.92), and the lack of social support (1.43). Our results were consistent with previous findings.[8, 10, 11, 17, 20, 24, 27, 31-34] Watanabe *et al*. reported that maternity blues was a strong predictor of PPD, and the higher the blues score, the higher the risk of PPD (odds ratio=9.57).[27] Youn *et al*. also demonstrated that maternity blues, as well as prenatal depression and the lack of social support, were associated with the development of PPD in Korean mothers.[20] Beck found that maternity blues was one of the important predictors of PPD.[10] Thus, we must pay particular attention to mothers with maternity blues in order to prevent the development of PPD.[14, 17] Similar to maternity blues, prenatal depression, low self-esteem, and the lack of social support were identified as significant predictors of PPD. These results agree with previous findings.[13, 19] Thus, we must also pay close attention to women lacking social support and/or with a past history of prior or prenatal depression.

With an appropriate prenatal cut-off value of 7.0, sensitivity and specificity were 50.0% and 87.0%, respectively. These results are consistent with previous findings reported by Ikeda *et al*.[13], but were inferior to those by Oppo *et al*.[19] However, in the study by Oppo *et al*. PDPI-R was performed at 8 months of gestation.[19] The different timing of PDPI-R may have led to different cut-off values. With the postpartum cut-off value of 8.0, sensitivity and specificity were 66.7% and 88.0%, respectively. Sensitivity was inferior, while specificity was superior to those reported by Ikeda *et al*.[13] and Oppo *et al*.[19] The reasons for these discrepancies currently remain unclear. In the present study, the sensitivity and positive predictive value of PDPI-R were higher in the postpartum version than in the prenatal version, and this was attributed to the timing of postpartum PDPI-R being near to the onset of PPD. The results of the present study demonstrated that PDPI-R was characterized by higher specificity and a higher negative predictive value. However, a careful follow-up and appropriate counselling are necessary for reducing the risk of PPD in women with more than an appropriate cut-off value. In addition, there was a positive correlation in the total score of both prenatal and postpartum versions. Thus, the Japanese version of PDPI-R is a useful instrument for predicting PPD in not only the postpartum, but also prenatal period. This is important for supporting women at high risk for PPD during pregnancy.

We identified appropriate cut-off values of 7.0 in the prenatal and 8.0 in the postnatal version of PDPI-R. The higher postpartum cut-off value was attributed to it having more variables. However, disagreements persist with regard to the cut-off value of PDPI-R.[13, 14, 19, 35] Possible explanations for this discrepancy may include the following. Ikeda *et al*. reported that an appropriate prenatal cut-off value was 6.0 and postpartum cut-off value was 8.0 in the Japanese version.[13] Their postpartum cut-off value was the same ours. Possible reasons for the slight difference in the prenatal cut-off value may include differences in the number of enrolled subjects, percentage of single mothers, low socio-economic status, and those with a past history of depression among the enrolled subjects. In the present study, subjects with medically-treated psychiatric disorders were excluded, but were included in the study by Ikeda *et al*.[13] In the study by Ikeda *et al*., all subjects were urban women without a low socio-economic status and with a high education level, which was significantly different from our study on primi-, multiparous women, in which a quarter of women had a low socio-economic status. Furthermore, we performed a prenatal examination within 6 months of pregnancy, while Ikeda *et al*. conducted theirs at 8 months of pregnancy.[13] These differences may have led to slight differences in prenatal cut-off values. Beck *et al*. previously reported a postpartum cut-off value of 10.5.[14] However, PDPI-R was examined at two and six months postpartum. PPD occurs four weeks after delivery, and its risk increases within the first 3 months of delivery.[36] Thus, the cut-off value of PDPI-R may become high at two months postpartum. Additionally, there were 10 to 13 variables in PDPI-R; however, the distribution of each variable may differ with the population examined. In the present study, marital dissatisfaction (odds ratio = 2.26) in the prenatal version, and maternity blues (4.71) and prenatal depression (5.22) in the postpartum version were significant predictors of PPD. Odds ratios of maternity blues and prenatal depression were high, despite the lower scale and scoring. When some variables with a low scale and scoring, but a high odds ratio, such as marital dissatisfaction, maternity blues, prenatal depression, and prior depression, are one-sided and strong (i.e., high odds ratio) predictors of PPD, the cut-off value may become low. Oppo *et al*. previously reported low cut-off values (4.0 in the prenatal and 6.0 in the postpartum version), with high odds ratios for maternity blues (odds ratio=4.9) and prenatal depression (9.97),[19] and these two variables were given a low scale (0 or 1). In the study by Ikeda *et al*., the percentages of prenatal depression and prior depression in the prenatal version were two-fold higer than our values.[13] Thus, the cut-off value of PDPI-R may differ with the distribution of variables. Furthermore, a previous study reported that the incidence of suicide attempt due to depression differed between the climates in the northern and southern parts of Japan.[37] Regional variations may exist in the prevalence of PPD even in the same country.[38] Thus, cut-off values may be slightly different among the urban and rural, as well as southern and northern parts of a country, as shown by the present study and by Ikeda *et al*.[13] The accuracy of EPDS may also be involved in the difference observed in PDPI-R cut-off values. An extreme dominance in false positive cases of EPDS in the studied population may be associated with lower PDPI-R cut-off values, while extreme dominance in false negative cases of EPDS may be associated with higher PDPI-R cut-off values. In addition, differences in the manner by which the EPDS examination was conducted, interviews or self-report questionnaires, may produce different PDPI-R cut-off values. Moreover, differences in the EPDS cut-off values may influence PDPI-R cut-off values. Low cut-off values for EPDS may be associated with low cut-off values for PDPI-R.

However, this possibility may be denied by the relatively low EPDS cut-off value (9.0) with a high cut-off value for PDPI-R in our study and Ikeda's study,[13] and the relatively high EPDS cut-off value (13.0) with a low cut-off value for PDPI-R in the study by Oppo *et al*.[19]

Other than a prenatal examination of PDPI-R, the ideal timing of the postpartum PDPI-R examination currently remains unclear. Maternity blues is a strong predictor of the development of PPD,[10, 17, 20, 27, 30-34] occurs within the first few days of delivery, and continues for one week. Therefore, one to two weeks after delivery may be the ideal timing for the early identification of the risk factors for PPD using PDPI-R. However, mothers and babies are at home during this period. The first month after delivery is the most critical timing for mothers with psychiatric symptoms including PPD.[39] In addition, in Japan, mothers and babies routinely visit hospitals for health check-ups one month after delivery. Thus, one month after delivery may be a practical time point to perform PDPI-R.

Based on these results, we concluded that the Japanese version of PDPI-R is a useful instrument for predicting PPD. The advantage of PDPI-R includes its ability to predict PPD not only in the postpartum period, but also in the prenatal period. In Kagoshima, which located in the southern part of Japan, an appropriate cut-off value of PDPI-R may be 7.0 in the prenatal version and 8.0 in the postnatal version, in the absence of a past history of medically-treated (postpartum) depression and psychosis. Appropriate cut-off values of PDPI-R may differ based on the regions examined, therefore, cut-off values need to be determined in accordance with regions, even in the same country. Our study had some limitations including the small number of enrolled subjects in a restricted, rural, and southern part of Japan. We also did not conduct PDPI-R in pregnant women living in the northern part of Japan. Thus, a more extensive study is necessary and warranted in order to determine whether cut-off values differ based on the region examined in Japan.

Disclosure of potential conflict of interests

All authors declare that they have no financial relationships with biotechnology manufacturers, pharmaceutical companies, or other commercial entities with an interest in the subject matter or materials discussed in this manuscript.

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Postpartum Depression Predictors Inventory-Revised (PDPI-R) 日本語版による産後うつ病発生の予測に関する検討

若松美貴代[1*)]、中村雅之[2)]、春日井基文[2)]、肝付洋[2)]、沖利通[3)]、折田有史[3)]、戸上真一[3)]、小林裕明[3)]、佐野輝[2)]、堂地勉[3)]

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目的：産後うつ病（Postpartum Depression：PPD）は本人の自殺，パートナーや子供のメンタルヘルス，認知機能，社会的・情緒的発達，虐待とも関連する。PPD 関連の自殺者は産科出血による死亡数より多いとする報告もある。故に妊娠中，産褥早期にリスク因子を見つけてケアすることが重要である。今回米国で開発された Postpartum Depression Predictors Inventory-Revised (PDPI-R) を産褥期だけでなく妊娠中にも検査し，PPD を妊娠期に予測出来るか否かを検討した。
方法：2012 年 12 月から 2015 年 2 月までに，鹿児島県内産婦人科に通院中，または入院中の妊婦で精神科疾患の既往がなく研究同意が得られた者を対象とした。PDPI-R は日本語に翻訳した後に逆翻訳し，原尺度と比較検討し日本語，英語について整合性の得られたもので日本語翻訳を完成させた。妊娠 10-23 週に PDPI-R (自己評価票) 産前版（social support の欠如，life stress などのリスク因子 10 項目，0-32 点満点）と産褥 1 ヶ月に PDPI-R 産後版（産前版 10 項目 + 育児ストレス，子どもの気質，maternity blues のリスク因子 3 項目，合計 13 項目，0-39 点満点）を実施し産前と産後の 2 時点で完全に解答し終えた 120 人を対象とした。PPD のスクリーニングはエジンバラ産後うつ病自己評価票 9 点以上とした。Receiver operating characteristic curve を用いて，PDPI-R の妥当な cut-off 値を決め，PPD のハイリスク群が予測出来るか否かを検討した。
結果：1）PPD は 12 人（10%）であった。2）妊娠中 PDPI-R の cut-off 値を 7.0 に決定したとき，PPD 予測の感度は 50.0%（6/12），特異度は 87.0%（94/108）であり，cut-off 値 6.0，8.0 のそれらに比較して優れていた。陽性，陰性的中率も 7.0 が優れていた。3）産褥期 PDPI-R の cut-off 値を 8.0 にしたとき，感度は 66.7%（8/12），特異度 88.0%（95/108）であり，cut-off 値 7.0 と 9.0 のそれらに比較して優れていた。陽性，陰性的中率も 8.0 が優れていた。
結論：PDPI-R 日本語版は産褥期だけでなく妊娠中から産後うつ病のハイリスク群を予測できる有用な方法である。本研究での PDPI-R の cut-off 値は妊娠中で 7.0，産褥 1 ヶ月で 8.0 が妥当であると思われた。我々の設定した cut-off 値は本邦の他の報告と類似するが，欧米の報告より cut-off 値が高かった。

Author Index

第68巻　人名検索

D

Douchi Tsutomu　堂地　勉　9

I

Ishigami Nobuharu　石神　信治　1

K

Kasugai Motofumi　春日井　基文　9
Kimotsuki Hiroshi　肝付　洋　9
Kobayashi Hiroaki　小林　裕明　9

N

Nakamura Masayuki　中村　雅之　9

O

Oki Toshimichi　沖利　通　9
Orita Yuji　折田　有史　9

S

Sano Akira　佐野　輝　9

T

Togami Shinichi　戸上　真一　9

W

Wakamatsu Mikiyo　若松　美貴代　9

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