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RESEARCH ARTICLE

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Are pelvic adhesions associated with pain, physical, emotional and functional characteristics of women presenting with chronic pelvic pain? A cluster analysis

Ying Ching Cheong^{1,2,4*}, Mili Saran¹, James William Hounslow¹ and Isabel Claire Reading³

Abstract

Background: Chronic pelvic pain is a debilitating condition. It is unknown if there is a clinical phenotype for adhesive disorders. This study aimed to determine if the presence or absence, nature, severity and extent of adhesions correlated with demographic and patient reported clinical characteristics of women presenting with CPP.

Methods: Women undergoing a laparoscopy for the investigation of chronic pelvic pain were recruited prospectively; their pain and phenotypic characteristics were entered into a hierarchical cluster analysis. The groups with differing baseline clinical and operative characteristics in terms of adhesions involvement were analyzed.

Results: Sixty two women were recruited where 37 had adhesions. A low correlation was found between women's reported current pain scores and that of most severe ($r = 0.34$) or average pain experienced ($r = 0.44$) in the last 6 months. Three main groups of women with CPP were identified: Cluster 1 ($n = 35$) had moderate severity of pain, with poor average and present pain intensity; Cluster 2 ($n = 14$) had a long duration of symptoms/diagnosis, the worst current pain and worst physical, emotional and social functions; Cluster 3 ($n = 11$) had the shortest duration of pain and showed the best evidence of coping with low (good) physical, social and emotional scores. This cluster also had the highest proportion of women with adhesions (82%) compared to 51% in Cluster 1 and 71% in Cluster 2.

Conclusions: In this study, we found that there is little or no correlation between patient-reported pain, physical, emotional and functional characteristics scores with the presence or absence of intra-abdominal/pelvic adhesions found during investigative laparoscopy. Most women who had adhesions had the lowest reported current pain scores.

Keywords: Adhesions, Chronic pelvic pain, Quality of life, Cluster analysis, Laparoscopy

Background

Chronic pelvic pain (CPP) is a debilitating condition with a heterogeneous etiology, affecting in primary care, 38 per 1000 women, which is comparable with that of back pain (41 per 1000) and asthma (37 per 1000) [1]. 20% of all gynecological outpatient appointments are attributable to patients with CPP. The diagnosis, investigations and treatment of women with chronic pelvic pain are often

orientated at treating organic pathology. Whilst treatment of conditions such as endometriosis may improve pain symptoms [2], women with conditions such as pelvic adhesions or apparently normal pelvises at laparoscopy (up to 55%) [3] often have a less defined treatment pathway, resulting in many of them having unexplained symptoms and being frequent attenders of clinics and hospitals [4]. Except for short-term use of progestogens or GnRHa, there are currently a limited number of effective interventions for non-endometriosis related CPP [5]. A multidisciplinary integrated, compared to traditional medical and/or surgical management has been proposed as a more effective model of care [6].

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50 The management of pelvic adhesions in women with
51 chronic pelvic pain is controversial; whilst some gynecolo-
52 gists will routinely perform adhesiolysis in the presence of
53 adhesions, others do not. We and others have previously
54 shown that adhesiolysis may only benefit a subgroup of yet
55 uncharacterized patients [7, 8], although Cheong et al.,
56 2014 was stopped before recruitment reached a statistically
57 powered sample size due to low enrollment. Swank et al.,
58 2003 did not report this benefit [9]. There is some evidence
59 to suggest that dense and vascular adhesions are more
60 likely to result in pain, and the traditional belief that adhe-
61 sions attached to pain sensitive structures such as ovaries
62 are more likely to result in more pain [7]. However, a study
63 by Rapkin et al., 1986, did not find an association between
64 density or site of adhesions and pelvic pain [10]. A retro-
65 spective study by Steege and Stout (1991) found the pres-
66 ence of psychosocial compromise was associated with a
67 lack of salutary response with adhesiolysis [11], suggesting
68 perhaps the 'adhesion phenotype' may relate, not just to
69 the physical-mechanistic aspect of adhesions, but also to
70 the psychosocial characteristic of the patients.

71 The presence, site and nature of adhesions observed
72 intra-operatively is often unpredictable pre-operatively
73 and whilst one expects patients with previous laparot-
74 omy to have more abdominal or pelvic adhesions than
75 those who had previous laparoscopic surgery, laparot-
76 omy and laparoscopy are associated with comparable
77 risks of adhesion related operative and non-operative
78 morbidity [12, 13]. There is only moderate correlation
79 between skin scar characteristics and intra-abdominal
80 adhesions [14]. Moreover, significant number of patients
81 in the aforementioned study did not have CPP and many
82 with CPP may not have had previous surgery.

83 Whilst clinical phenotyping has been shown to be
84 helpful for the management of patients with chronic
85 pain syndromes [15–17], a clinical phenotype for adhe-
86 sive disorders in terms of pain, physical, emotional and
87 functional characteristics of women presenting with
88 adhesions and non-adhesions related chronic pelvic pain
89 has not yet been defined. Identifiable clinical characteris-
90 tics may help facilitate better surgical decisions making
91 and serve as better tools for pre-operative counseling.

92 We aim to determine if adhesions correlated with
93 demographic and patient reported clinical characteristics
94 of women presenting with CPP.

95 **Methods**

96 This study was conducted between December 2010 and
97 December 2014 with a total recruitment time of
98 approximately 18 months. Participants who required a
99 laparoscopy to investigate their chronic pelvic pain were
100 screened and recruited. The inclusion criteria were: 1)
101 woman's age over 18; 2) presence of chronic pelvic pain
102 defined as pelvic pain which is constant/cyclical in

nature for greater or equal to 6 months duration; 3) 103
written consent. The exclusion were: 1) malignancy; 2) 104
diagnosed psychiatric disorders such as bipolar disor- 105
ders, bipolar disorders etc. for which the patient has 106
received a psychiatric diagnosis and was on medication; 107
3) pathology which requires urgent treatment, such as 108
ovarian cyst or pelvic abscess; 4) women taking central 109
nervous system stimulants; 5) hormonal treatment; 6) 110
pregnancy and 7) known diagnosis of endometriosis. 111

At recruitment, pain scores were measured with the 112
VAS (visual analogue score) from the McGill pain ques- 113
tionnaire. The McGill pain questionnaire is a self-report 114
questionnaire for intensity and quality of pain [18]. 115
Quality of life measures were obtained using SF-12 116
(medical outcomes study with 12 item short-form health 117
survey), which is a short generic measure of subjective 118
health status including 12 items encompassing the self- 119
assessment of health, physical functioning, physical role 120
limitation, mental role limitation, social functioning, 121
mental health and pain) and modified EHP-30 (endo- 122
metriosis health profile) questionnaire for pelvic pain 123
[19, 20]. The EHP-30 consists of core instruments on 124
five scale scores, namely pain, control and awareness, 125
social support, emotional well-being and self-image; it is 126
a health related quality of life patient self-report, used to 127
measure the wide range of effects of endometriosis. 128

Laparoscopic surgeons skilled in advanced laparoscopy 129
performed the surgery where the entry into the abdo- 130
men was either via the open technique or the traditional 131
Veress needle. CO₂ pneumo-peritoneum was created 132
with 20 mmHg, before the intra-umbilical insertion of 133
the 10 mm trocar, with or without the insertion of two 134
or three more extra ports. The principles of microsurg- 135
ery were followed during the surgery, with meticulous 136
hemostatic control and constant irrigation to reduce the 137
risk of tissue desiccation. 138

A standard proforma was used to document the pa- 139
tient's history, clinical examination and operative findings 140
with the extent, severity and site of any adhesions scored 141
with a well-validated adhesion scoring system¹⁵. The 142
information gathered regarding pain and quality of life 143
assessment through the VAS, SF-12 and EHP-30 scores 144
were entered into a computerized database. 145

The primary outcome measure was pain score (VAS) 146
and the secondary outcomes were a) SF12 Health related 147
quality of life scores, the modified pelvic pain EHP-30 148
core questionnaire and the relevant clinical outcomes 149
which included complications and adverse events. 150

151 **Statistical analysis**

Women's pain, EHP and SF36 profile were included in a 152
hierarchical cluster analysis. Hierarchical cluster analysis 153
is a statistical technique which identifies those women 154
who are similar to each other in terms of their overall 155

156 profile and thus identifies data-driven rather than
 157 a-priori groups, or 'clusters,' of women with similar attri-
 158 butes. It is a powerful technique to identify patterns
 159 within data which makes no statistical assumptions of
 160 normality and can be used on small sample sizes.

161 We then explored whether the groups identified by
 162 this method had differing baseline clinical and operative
 163 characteristics in terms of adhesions involvement. These
 164 were presented in median scores ± interquartile range.

165 **Results**

166 Sixty-two women were recruited and entered into the ana-
 167 lysis. The following were thier baseline characteristics:
 168 median age (years) and interquartile range (IQR) of 31,
 169 IQR 26–35; the median length of time since the diagnosis
 170 of chronic pelvic pain to the women entering the study
 171 was 3.7 years, IQR (0.1–9.9) and a range of 1–34 years.
 172 Fifteen women had no children and 36 of them had one
 173 or more children, and 11 women did not answer this
 174 question. Sixteen women were single, twenty-seven were
 175 co-habiting, seventeen were married and two were
 176 divorced. 37 women had adhesions involving the respect-
 177 ive distribution (abdominal wall, 18; Adnexa, 20; uterus, 7;
 178 ovary, 12; bowel, 10) and 25 women had no adhesions.
 179 Three women who had adhesions were graded as severe
 180 and extensive, one in each cluster.

181 The correlation between women's reported current
 182 pain scores and that of most severe ($r = 0.34$) or average
 183 pain experienced ($r = 0.44$) in the last 6 months was low.

184 Cluster analysis of the database was performed with 62
 185 patients' data. Three main groups of women with CPP
 186 were identified (Cluster 1–3) (Fig. 1, Dendrogram of hier-
 187 archical cluster analysis) with two women with a short
 188 duration of much milder symptoms found as outliers in
 189 a fourth cluster ($n = 2$, excluded from further analysis).
 190 Table 1 shows the cluster characteristics with the mean
 191 scores for SF36, EHP and McGill questionnaires.

192 Patients who fell into Cluster 1 ($n = 35$) to the left of
 193 the dendrogram in Fig. 1 had moderate severity of pain,
 194 with their worst pain intensity in the last 6 months (VAS
 195 score, median ± IQR) at 10 (9, 10), their average pain int-
 196 ensity in the last 6 months at 7 (6–8), and their present
 197 pain at 34 (18–62). Cluster 2 ($n = 14$) in the middle of
 198 the dendrogram consisted of women who had chronic
 199 pelvic pain symptoms diagnosed for the longest duration
 200 (comparative to the cohort), at 9.9 (2.8–14.7) years, the
 201 worst current pain (67 (51–78)) VAS scores and worst
 202 physical, emotional and social functions. In Cluster 3, to
 203 the right of the dendrogram, women had the shortest
 204 duration of pain history (2 years, (1–4.3)) and showed
 205 the best evidence of coping with low (good) physical,
 206 social and emotional scores.

207 Cluster 1 was the largest cluster identified, although Fig.
 208 1 illustrates that this group was made up of three distinct

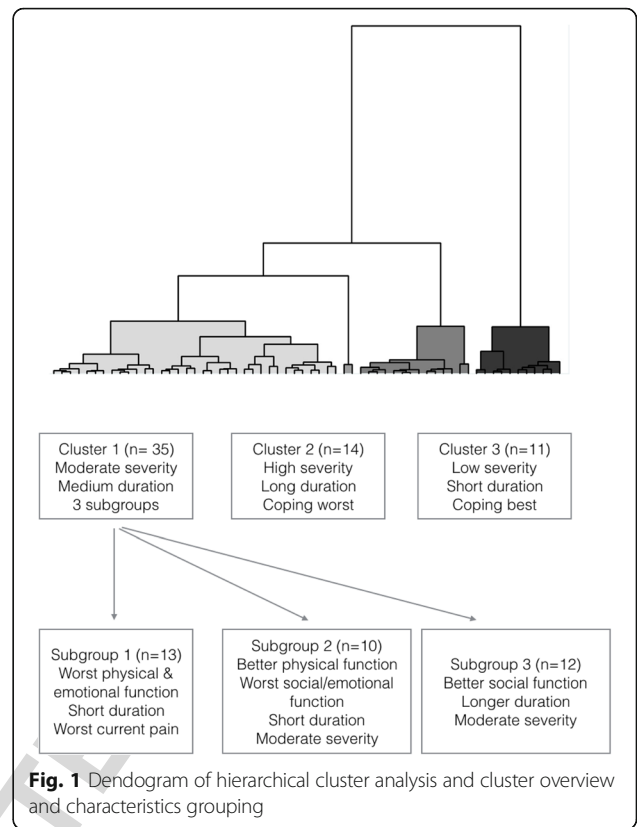


Fig. 1 Dendrogram of hierarchical cluster analysis and cluster overview and characteristics grouping

f1.1
f1.2
f1.3

209 smaller clusters of similar size. These three subgroups
 210 comprised those with a short duration of symptoms but
 211 worst pain, and physical function and poor social function
 212 (Subgroup 1, $n = 13$); those with a short duration of pain
 213 and better physical function but worse social and
 214 emotional function (Subgroup 2, $n = 10$); and those with a
 215 moderate pain severity and a longer duration of symptoms
 216 but better social function (Subgroup 3, $n = 12$).

217 The site, presence or absence of adhesions is shown in
 218 Table 2. There was no correlation of the nature of pain
 219 and the site or type of adhesions present during laparos-
 220 copy. 51% ($n = 18$), 71% ($n = 10$) and 82% ($n = 9$) of
 221 women in Clusters 1 to 3 respectively had adhesions.
 222 Thus, the cluster with the lowest current median pain
 223 scores (Cluster 3) had the highest proportion of women
 224 with adhesions.

225 **Discussion**

226 In this study, we found that there is little or no correlation
 227 with the presence or absence of intra-abdominal/pelvic
 228 adhesions during diagnostic laparoscopy and the patient
 229 reported pain, physical, emotional and functional charac-
 230 teristics. The greatest proportion of women who had the
 231 least reported current pain. The longest duration of CPP
 232 captured in our study was 34 years. We also did not find
 233 any correlation with the nature of pain (severity, duration
 234 and intensity of pain) and the site or type of adhesions

T2

Q4 1.1 **Table 1** Hierarchical clustering of patients in accordance to their pain, modified EHP and SF 36 profile, and Cluster 1 sub-groups

	Cluster 1 (n = 35)	Cluster 2 (n = 14)	Cluster 3 (n = 11)
t1.2 Characteristics			
t1.3 Physical SF 36	37.5 (18.8–50)	18.75 (12.5–37.6)	87.5 (81.3–87.8)
t1.4 Emotional SF 36	36.25 (28.8–43.8)	18.75 (10–25)	77.5 (68.7–82.5)
t1.5 EHP Pain	56.8 (50–64)	72.7 (70–77)	29.5 (9–36)
t1.6 EHP Control	75.0 (62.5–87.5)	93.75 (83.3–100)	41.7 (20.8–54.2)
t1.7 EHP Emotion	58.3 (41.7–66.7)	87.5 (75–100)	8.3 (0–37.5)
t1.8 EHP Social	56.3 (37.5–68.8)	84.3 (75–100)	25 (6.3–50)
t1.9 EHP Image	50 (33.3–66.7)	83.3 (75–83.3)	8.3 (0–33.3)
t1.10 Length of surgery/diagnosis (years)	4 (0.7–9.5)	9.9 (2.8–14.7)	2 (1.0–4.3)
t1.11 Worst pain intensity in the last 6 months (0–10)	10 (9–10)	10 (9–10)	8 (6–9)
t1.12 Average pain intensity in the last 6 months (0–10)	7 (6–8)	8 (7–9)	5 (4–7)
t1.13 Pain score today (0–100)	34 (18–62)	67 (51–78)	16 (2–23)
t1.14	Cluster 1 subgroups		
t1.15 Characteristics	Subgroup 1 n = 13	Subgroup 2 n = 10	Subgroup 3 n = 12
t1.16 Physical SF 36	18.75 (18.75–32.25)	59.4 (44–69)	37.5 (28.1–43.8)
t1.17 Emotional SF 36	35 (26.3–38.75)	38.8 (32.5–61.3)	36.25 (29.4–43.8)
t1.18 EHP Pain	61.3 (56.8–70.4)	52.3 (50–66)	56.8 (43.2–61.4)
t1.19 EHP Control	79.2 (78–87.5)	72.9 (58.3–87.5)	62.5 (56.3–79.2)
t1.20 EHP Emotion	62.5 (50–66.6)	66.7 (54.2–83.3)	43.8 (37.5–60.4)
t1.21 EHP Social	50 (43.8–62.5)	71.9 (56–81)	37.5 (31.3–59.4)
t1.22 EHP Image	50 (41.7–66.7)	41.7 (33.3–66.7)	41.7 (4.2–66.6)
t1.23 Length of surgery/diagnosis (years)	1.6 (0.5–4.4)	1.8 (0.7–3.8)	9.6 (6.3–14.6)
t1.24 Worst pain intensity in the last 6 months (0–10)	10 (9–10)	10 (9–10)	10 (8.5–10)
t1.25 Average pain intensity in the last 6 months (0–10)	8 (7–8)	6.5 (6–8)	7 (6.5–8)

235 present during laparoscopy in women presenting with
 236 chronic pelvic pain. We found the correlation between the
 237 reported current pain scores and that of most severe ($r =$
 238 0.34) or average pain experienced ($r = 0.44$) in the last
 239 6 months captured by the questionnaires to be low which
 240 is not surprising given that the characteristics of pain gener-
 241 ally vary over time. As endometriosis pain may be more
 242 inflammatory and neurogenic in origin, we did not include
 243 this group of women in our analysis.

244 Women who presented at our gynecological service
 245 fell into three clinical characteristics clusters; namely
 246 those currently with a low severity of pain, short

247 duration and were apparently coping best, those who
 248 have moderate severity of pain, with medium duration
 249 of symptoms with varying coping scores, and the third
 250 cluster whose current symptoms are the most severe,
 251 had pain for a long duration and appeared to be coping
 252 worst. It is not known if the social, emotional and phys-
 253 ical scores deteriorate with the duration of pain symp-
 254 toms in chronic pelvic pain sufferers, that is, if these
 255 cluster characteristics are progressive for any individual,
 256 but such a hypothesis is highly plausible and will have to
 257 be further explored by longitudinal studies. However, we
 258 found some subgroups of women who, despite long du-
 259 rations of pain had good social and emotional scores
 260 and vice versa, suggesting that women display a variety
 261 of characteristics that do not necessarily correlate with
 262 each other in terms of severity or duration.

263 Our cluster analysis has highlighted that women with
 264 CPP can present with quite distinct profiles of character-
 265 istics and the traditional gynecological approach to history
 266 taking and management strategy will not be adequate for
 267 their pain and expectation management. A cognitive
 268 behavioral-based assessment, which involved the assess-
 269 ment of cognitive, emotional, behavioral and physical
 270 assessment of the patient has been advocated to facilitate

t2.1 **Table 2** Distribution of adhesions in each cluster

t2.2 Sites	Cluster 1 (n = 35)	Cluster 2 (n = 14)	Cluster 3 (n = 11)
t2.3 Abdominal wall	11	5	3
t2.4 Ovary	7	1	2
t2.5 Bowel	6	2	3
t2.6 Adnexa	8	2	6
t2.7 Uterus	6	0	1
t2.8 Total number of women with adhesions in each group	18 (51%)	10 (71%)	9 (82%)

271	the initial assessment and pain management referral [22],	approval of the final version. All authors read and approved the final	324
272	although due to various organizational and financial	manuscript.	325
273	reasons, such a model of management has not been trialed		
274	nor is routinely used in the management of CPP.		
275	Recall bias may account for the lack of correlation of	Ethics approval and consent to participate	326
276	patient reported current pain scores compared to worst or	The study was reviewed and approved by the South Sheffield Ethics	327
277	average pain in the last 6 months, and perhaps future	Committee (05/Q2305/158) and R&D approval from University Hospital	328
278	research can explore more continuous monitoring of the	Southampton NHS Foundation Trust. We confirmed that written consent was	329
279	CPP patient to better and more accurately reflect the phys-	obtained from participants and the method of laparoscopy is considered	330
280	ical, functional and emotional aspects of sufferers of CPP.	standard care.	331
281	Whilst the sample size of this study is limited to 62 partici-	Consent for publication	332
282	pants, the use of hierarchical cluster analysis is a useful	Not applicable	333
283	exploratory tool to identify possible patterns in the data	Competing interests	334
284	which makes no assumptions of normality. Our study only	The authors declare that they have no competing interest.	335
285	focused on the presence and absence of adhesions, and		
286	had not specifically teased out conditions such as abdom-	Publisher's Note	336
287	inal wall and pelvic floor myofascial pain, neuropathic	Springer Nature remains neutral with regard to jurisdictional claims in	337
288	pain, irritable bowel syndrome, and bladder pain	published maps and institutional affiliations.	338
289	syndrome, which could have increased the heterogeneity		
290	of our study population. However, a significant majority of	Author details	339
291	practitioners in our practice, would not normally carry out	¹ University Hospitals Southampton NHS Trust, Princess Anne Hospital,	340
292	specific tests to include or exclude these conditions and	Mailpoint 105, Cxford Road, Southampton SO16 5YA, UK. ² University of	341
293	hence such details were not available to us.	Southampton Faculty of Medicine, Human Development and Health,	342
		Princess Anne Hospital, Mailpoint 815, Cxford Road, Southampton SO16	343
		5YA, UK. ³ Primary Care and Population Sciences, Human Development and	344
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		General Hospital, Tremona Road, Southampton SO16 6YD, UK. ⁴ University of	346
		Southampton, Obstetrics & Gynaecology, Princess Anne Hospital, Mail point	347
		815, Cxford Road, Southampton SO16 5YA, UK.	348
294	Conclusions	Received: 4 August 2016 Accepted: 29 December 2017	349
295	In women with chronic pelvic pain, clinical characteristics		350
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298	with adhesions from those without prior to surgery. How-	chronic pelvic pain: systematic review. <i>BMJ</i> . 2006;332(7544):749–55.	353
299	ever, our cluster analysis highlights that women with CPP	2. Practice Committee of the American Society for Reproductive M. Treatment	354
300	can present with quite distinct profiles of characteristics.	of pelvic pain associated with endometriosis: a committee opinion. <i>Fertil</i>	355
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309	The authors would like to thank all the research nurses and the clinic staff	6. Peters AA, van Dorst E, Jellis B, van Zuuren E, Hermans J, Trimbos JB. A	364
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318	YC contributed to the conception, design, acquisition of data, analysis and	<i>Health</i> . 2014;14(1):36.	373
319	interpretation of data, involved in drafting and revising the manuscript	9. Swank DJ, Swank-Bordewijk SC, Hop WC, van Erp WF, Janssen IM, Bonjer HJ, et al.	374
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321	drafting the manuscript and revising it critically for important intellectual	randomised controlled multi-centre trial. <i>Lancet</i> . 2003;361(9365):1247–51.	376
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