

**Post Traumatic Stress Disorder (PTSD): the psychological sequelae of Abnormally Invasive
Placenta (AIP)**

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1 Abstract

2 **Introduction:** Abnormally invasive placenta (AIP) is a rare pregnancy complication
3 often resulting in postpartum haemorrhage (PPH) and emergency peripartum
4 hysterectomy (EPH). The risk of developing post traumatic stress disorder (PTSD)
5 following unexpectedly traumatic childbirth is known however there is no evidence
6 regarding PTSD in AIP. This pilot study assesses the risk of PTSD for women with
7 AIP compared to women having an uncomplicated caesarean delivery (CD) or
8 unexpected PPH or EPH.

9

10 **Methods:** Retrospective case-controlled questionnaire study in a UK Tertiary
11 obstetric unit. Women with AIP (Group-1) were matched by delivery date to control
12 groups: Group-2, women with an uncomplicated CD; Group-3 women referred to a
13 specialist clinic for suspected AIP, but had a normal placenta and uncomplicated CD;
14 Group-4, women who had an unexpected EPH and/or severe (>3000mls) PPH. 218
15 women were sent a validated PTSD screening questionnaire (Impacts of Events Scale-
16 Revised [IES-R]).

17

18 **Results:** Likelihood of PTSD was recorded for 69 women who responded, revealing
19 significantly higher PTSD scores for women with AIP compared to uncomplicated
20 CD ($P=0.001$). No significant difference was seen between AIP and EPH/PPH
21 ($P=0.89$). The number of women with scores high enough to indicate probable PTSD
22 was significantly greater with AIP than uncomplicated CD group ($P=0.045$).

23

24 **Discussion:** This study demonstrates that women antenatally diagnosed with AIP and
25 anticipating a potentially traumatic delivery, are at significantly increased risk of
26 developing PTSD. Improved awareness of the negative psychological impact of AIP
27 may increase the number of women being identified and treated, thereby improving
28 their quality of life.

29

30 **Keywords:** Abnormally invasive placenta, Placenta Accreta, Post traumatic stress
31 disorder, Postnatal mental health

32

Introduction

Abnormally invasive placenta (AIP: also called placenta accreta spectrum) is a rare obstetric complication affecting around 1-3 in every 10,000 births¹ in Europe but the incidence has been reported to be higher in other countries including the USA. It is the leading cause of caesarean hysterectomy in the developed world² with the average blood loss being reported to be as high as 3 to 5 litres.³ The predominant risk factor is previous caesarean delivery (CD), a procedure that has dramatically increased in frequency over the past 50 years.^{4,5} Caesarean birth rates are projected to rise further in the future,⁶ with the prevalence of AIP likely to follow suit.⁷ It is therefore important that clinicians understand not only how to manage the condition to reduce physical morbidity but also the potential long-term psychological consequences for women affected.

Adverse psychological outcomes including post-traumatic stress disorder (PTSD) have been reported as a result of traumatic birth events including severe postpartum haemorrhage (PPH) and emergency postpartum hysterectomy (EPH).⁸ A recent report from France demonstrated that 64% of women who underwent an unplanned hysterectomy at the time of delivery suffered from PTSD.⁹ A study published in 2011,¹⁰ showed that 76% of women who had suffered severe PPH during birth experienced negative memories following delivery, with 41% reporting persistent problems. Of these individuals, 57% thought about the delivery for at least a month after, 18% had an unshakeable fear of dying and 11% said that the event played at least some part in relationship difficulties or divorce. This demonstrates that both significant blood loss and hysterectomy at delivery, as seen with AIP, can contribute to a number of negative psychological responses. Furthermore, narratives from women experiencing EPH report grief for the loss of the uterus and degradation of feminine identity.¹¹

These findings, however, may not be directly applicable to women with AIP as unlike many of the participants of the published studies, women with an antenatal diagnosis of AIP are prepared for planned hysterectomy with the possibility of severe PPH and are usually delivered electively by a senior obstetrician and experienced

Abbreviations:

PTSD – post traumatic stress disorder
AIP – abnormally invasive placenta/placenta accreta
CD – caesarean delivery
EPH – emergency postpartum hysterectomy
PPH – postpartum haemorrhage
EBL – estimated blood loss
IES-R – impact of events scale-revised

1 multi-disciplinary team. What is unknown is whether antenatal anticipation of these
2 outcomes influences the risk of developing PTSD as a result of the delivery.
3 Anecdotal evidence from informal questioning indicated that some women with AIP
4 were suffering significant psychological trauma but the true extent of the problem
5 remains unknown.

6 This pilot study aimed to assess the psychological impact, with particular
7 reference to PTSD, of the diagnosis and treatment for AIP in comparison to women
8 experiencing an uncomplicated CD; and whether these effects are comparable to those
9 seen with unexpectedly traumatic birth experiences.

10 11 Materials and methods

12 Women were eligible to take part if they were over the age of 16, willing and
13 able to give informed consent for participation and fluent in English. Women who had
14 given birth between September 2012 and September 2016 were eligible for inclusion.

15 The study group (Group 1; AIP) consisted of women who were referred to the
16 specialist placenta clinic and diagnosed with AIP on ultrasound, which was confirmed
17 at elective delivery using the FIGO intra-operative grading scheme ¹². They were
18 treated with either caesarean hysterectomy or conservative management (hysterotomy
19 to deliver the baby then uterine closure with the placenta left *in situ* and follow up
20 until the placenta had reabsorbed). The controls consisted of women who delivered in
21 the same obstetric unit.

22 Group 2 (CD) was women who were referred for CD due to a previous CD
23 and who experienced an uncomplicated CD with an estimated blood loss (EBL) of
24 <1L. Women were identified using the theatre log books. Details of the delivery were
25 then obtained from the hospital electronic records system to check for any
26 complications and confirm EBL and also to ensure they had not attended the specialist
27 placenta clinic.

28 Group 3 (Clinic+CD) consisted of women who were referred to the specialist
29 placenta clinic with risk factors for AIP however, following an ultrasound scan, were
30 cleared of the diagnosis. These women were only included if they were subsequently
31 delivered by an uncomplicated caesarean with an EBL <1L. Participants were
32 identified from the placenta clinic records and their delivery information was checked
33 on the hospital records to confirm an uncomplicated CD.

Group 4 (EPH/PPH) consisted of women who experienced unexpected severe PPH (EBL >3L requiring transfer to theatre) and/or an unanticipated EPH. All severe PPH and EPH cases generate a clinical governance form, which is then held on a hospital database. This database was used to identify women potentially meeting this criteria then the full details of their delivery were checked from their hospital records to confirm that there had been no antenatal reason to anticipate an increased risk of a complicated or traumatic birth.

All controls were case matched for date of delivery (+/- 3 months) with each AIP case in an attempt to minimise the confounding effect of differential recall occurring due to time since delivery. For every AIP participant (n=35), we endeavoured to identify two women in each control group (group 2, n=64; Group 3, n=53; Group 4, n=60) in an attempt to account for the low response rate usually seen with postal questionnaire studies and to increase the sample size and subsequent power of the study. The hospital electronic records of all potential participants were checked to ensure that there was no record of neonatal mortality or significant morbidity. This was to prevent confounding of the study results and avoid unnecessary distress to participants.

All potential participants were sent an invitation letter specific to their cohort (Document S1), a patient information sheet (Document S2), two consent forms (Document S3) and, a validated PTSD screen questionnaire (Document S4).

If no response was received within two weeks, a second set of documents were sent. If there was no reply to this no further contact was attempted to comply with the instructions of the local ethics committee. To mitigate poor response rates,¹³ questionnaires and letters were personalised; a stamped return envelope was included; packs were sent by first class post; and a second copy of documents along with a reminder letter were sent 2 weeks after the first pack.

Throughout the study, all women had the right to withdraw at any time, without giving a reason. Data was assessed within 2 weeks of receipt and individuals that screened positive for PTSD were informed and their GP was contacted so that a mental healthcare referral could be pursued where indicated. If women screened negative they were not contacted again.

1 The short, validated PTSD screening questionnaire, impact of events scale-
2 revised (IES-R),¹⁴ was used to indicate whether or not the woman was likely to be
3 suffering from PTSD. This tool is a 22 item self-reporting questionnaire that can be
4 used to identify increased probability of PTSD diagnosis. It takes around 5 minutes to
5 complete. Scores range from 0-88; below 24 indicates a low PTSD risk, 24-32
6 suggests PTSD is a clinical concern, 33 and above implies probable PTSD.¹⁴

8 **Statistical Analyses**

9 The data was tested for normal distribution using Kolmogorov-Smirnov
10 comparison test. Non-parametric tests (Mann Whitney U and Fisher's exact test) were
11 used where the data were not normally distributed. Statistical significance was
12 assumed at a p value of 0.05 or less.

14 **Ethical approval**

15 The study was undertaken following ethical review obtained from South
16 Central – Oxford B Research Ethics Committee on 11/11/2016 (16/SC/0516).

19 **Results**

20 Of the 218 women contacted, 69 replied (32% response rate): 17 out of 35 in
21 AIP (49% response rate), 14 out of 66 in CD (21%), 16 out of 53 in Clinic+CD (31%)
22 and 22 out of 65 in EPH/PPH (34%). Of the women with AIP who replied, 16 had an
23 immediate hysterectomy and 1 had successful conservative management. All had
24 histopathological confirmation of AIP and a clinical confirmation of an AIP FIGO
25 grade 4 or higher. Of the 22 women in the EPH/PPH group all had an unexpected
26 blood loss of greater than 3000mls and were transferred to the operating theatre but all
27 were managed conservatively with none having a hysterectomy.

28 Table 1 shows the time since delivery for all women that returned
29 questionnaires. There was no significant difference in time since delivery between the
30 AIP cohort and the other categories.

31 The PTSD screening scores for the EPH/PPH group were normally distributed
32 but the scores for the three other groups were not, therefore non-parametric tests were
33 used (Mann-Whitney U and Fisher's exact test). The median PTSD screening scores
34 for women with confirmed AIP and unexpected EPH/PPH (Table 2) were

1 significantly higher than those of women who had an uncomplicated CD ($P=0.001$).
2 The median PTSD screening scores for women who attended the specialist placenta
3 clinic for risk of AIP but went on to have an uncomplicated CD (Clinic+CD) were not
4 significantly different to women who were not at risk of AIP and just had an
5 uncomplicated CD ($P= 0.726$) (Table 2). No significant difference was seen between
6 the median IES-R scores for women with AIP when compared to women who had an
7 unexpected EPH/PPH ($P=0.89$).

8 A score of >32 on the IES-R represents the cut-off for probable PTSD.¹⁵ The
9 number of women scoring for probable PTSD was significantly greater in the AIP
10 cohort ($n=7$) than in the uncomplicated CD group ($n=1$, $P=0.045$). However, a
11 significant difference was not seen in the number of women with probable PTSD
12 between the uncomplicated CD and unexpected EPH/PPH group ($n=7$, $P=0.12$) or
13 clinic + CD group ($n= 0$, $P=0.47$).

14 15 Discussion

16 An unexpectedly traumatic birth experience has been shown to be associated
17 with an increased risk of developing PTSD.^{11 12} However, this is the first study to
18 demonstrate that women who are antenatally diagnosed with AIP and are therefore
19 anticipating a difficult, potentially traumatic delivery, are still at significantly
20 increased risk of developing PTSD.

21 PTSD is associated with a wide range of traumatic events including childbirth,
22 where an individual feels that their life is at risk. The neurobiology underpinning this
23 disorder remains unclear. Research has suggested that symptoms may arise as a result
24 of increased CSF catecholamine secretion,¹⁶ which can trigger the formation of
25 neurological patterns in the brain. Along with hypersensitivity of the amygdala¹⁷ and
26 hypoactivity of the anterior cingulate cortex,¹⁷ this is thought to increase the
27 likelihood of an individual reacting disproportionately to subsequent fearful
28 situations. AIP is associated with PPH and peripartum hysterectomy; critical events
29 that can be experienced as traumatic. Our findings indicate that being prepared for the
30 possibility of these life threatening circumstances does not necessarily mitigate the
31 risk of developing PTSD postnatally. Early detection of the psychological sequelae of
32 AIP through a systematic screening program might enable prompt intervention by
33 facilitating access to psychological and mental health services for women developing
34 PTSD.

1 Some women also returned narrative comments with the questionnaires,
2 reporting difficulties with intra-familial relationships alongside PTSD symptoms. One
3 woman stated “my birth experience has affected many relationships and so many
4 aspects of my life. People don’t recognise what I have lost as I have my son”. Others
5 revealed that they felt that their healthcare professionals outside of the hospital
6 setting, friends and family did not understand AIP and so were unable to empathise.
7 “To go from amazing care to no contact with people who understood was hard and
8 resulted in me shutting it all out too soon I think” Many also conveyed that they felt a
9 peer support group would have been beneficial for their recovery. This demonstrates
10 that approaches to addressing the negative psychological impact might include
11 increasing awareness of AIP and postnatal psychological risks among universal
12 healthcare professionals (GPs, midwives, health visitors) as they are most likely to be
13 the healthcare professionals in contact with the women.

14
15 The rarity of this condition means a small sample size was unavoidable. It was
16 impossible to perform a power calculation as there was no effect size estimate
17 available in the literature. Therefore, sample size was based on the maximum number
18 of women available from the database of women who had been diagnosed and treated
19 with AIP since the specialist service had been set up. Despite the low numbers
20 however, the results were statistically significant in support of the proposed
21 hypothesis demonstrating that there is likely to be a sizeable effect at play and that the
22 study was probably not underpowered for the simple question being investigated.

23 A prospective approach would be the ‘gold standard’ for this study, although it
24 would not necessarily completely eliminate recollection bias. However, the time
25 period required to prospectively recruit this number of women in a single centre
26 would be several years. Therefore, a retrospective case-control study was the most
27 practical design available for this pilot study. To mitigate recollection bias, we
28 attempted to case-control by delivery date. The results demonstrate that there was no
29 significant difference between the number of responses from women with AIP and
30 those from the other groups for any of the time periods indicating that the case
31 matching for time since delivery was reasonable. Studies such as this are also believed
32 to suffer selection bias, as those negatively affected by their experience are more
33 likely to respond which may explain the possibly surprising finding of a women in the
34 uncomplicated caesarean delivery group who reported symptoms of severe PTSD.

1 ‘Cold’ postal questionnaires are renowned for poor responses, usually in
2 single figures. To mitigate this we employed a number of modifications that have
3 been found to increase response ¹⁴ which may explain the relatively high 32% return
4 rate in this study.

5 As the study covered a period of 4 years there is the potential for bias due to
6 the MDT gaining more experience in managing AIP. However, we believe that this
7 bias will be minimal as the members of the MDT did not change and whilst our
8 management is always personalised to the unique circumstances of each woman, the
9 mainstay of our treatment has always been hysterectomy with only a small number
10 opting for expectant management.”

13 Conclusion

14 Caesarean section rates are rising and therefore cases of AIP are set to follow
15 suit. Our study has revealed that this could be associated with an increased prevalence
16 of women suffering from child-birth related PTSD. Currently there are no evidence
17 based interventions available to prevent PTSD.¹⁷ Contemporary understanding of the
18 condition indicates that post-event intervention should be the primary focus.
19 Therefore, healthcare professionals, especially those involved in postnatal care of
20 women, need to be educated about AIP and its potential negative psychological
21 impact so that these women at high risk of developing PTSD can be identified early
22 and access appropriate treatment.

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Table 1

Time since delivery for all women that returned questionnaires. Each group was compared to women with AIP.

	<6 months ago	p-value*	6-12 months ago	p-value*	12-18 months ago	p-value*	>18 months ago	p-value*
AIP	1 (6%)	-	5 (29%)	-	2 (12%)	-	9 (53%)	-
CD	(0%)	<i>1</i>	4 (29%)	<i>1</i>	4 (29%)	<i>0.37</i>	6 (42%)	<i>0.72</i>
Clinic+CD	1 (6%)	<i>1</i>	7 (44%)	<i>0.48</i>	4 (25%)	<i>0.4</i>	4 (25%)	<i>0.16</i>
EPH/PPH	4 (18%)	<i>0.15</i>	6 (27%)	<i>1</i>	1 (5%)	<i>1</i>	11 (50%)	<i>1</i>

P values compared to AIP, using *Fishers exact test

	Median IES-R score (range)	p-value*	Number of women at low risk of PTSD (<24 on IES-R)	Number of women at moderate risk of PTSD (24-32 on IES-R)	Number of women at high risk of PTSD (>32 on IES-R) [p-value^]
CD (n=14)	1.5 (0-47)	-	13	0	1 [-]
AIP	19 (2-76)	<i>0.001</i>	10	0	7 [0.045]

(n=17)					
Clinic+CD (n=16)	1.5 (0-15)	0.726	16	0	0 [0.47]
EPH/PPH (n=22)	28.5 (2-70)	0.001	13	2	7 [0.12]
P values compared to the control group of uncomplicated caesarean delivery (CD) using *Mann Whitney U test and ^Fishers exact test.					

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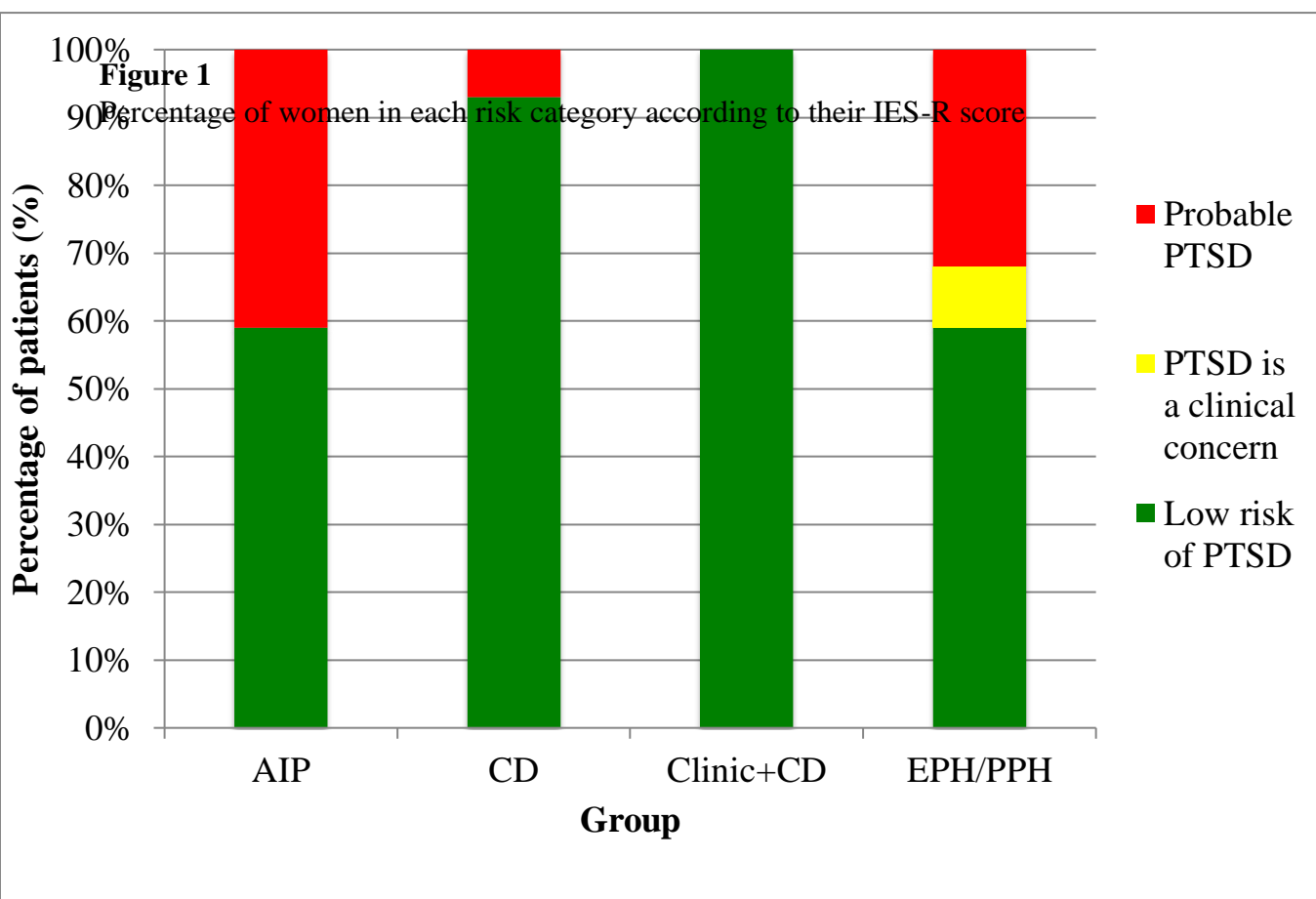
Table 2

Median IES-R scores for all groups and number of women in each risk category according to their IES-R score. P values are calculated

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