Management of Parkinson's Disease during pregnancy: literature review and multi-disciplinary input

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Abstract

Background

There are no standardised clinical guidelines for the management of Parkinson's disease during pregnancy. Increasing maternal age would suggest that the incidence of pregnancy in women diagnosed with Parkinson's disease is likely to increase.

Objective

To evaluate the evidence for the treatment of Parkinson's disease during pregnancy, and to canvass opinion from patients and clinical teams as to the optimum clinical management in this setting.

Methods

This involved: i) a literature review of available evidence for the use of oral medical therapy for the management of PD during pregnancy, and ii) anonymised survey of patients and clinical teams relating to previous clinical experiences.

Results

Literature review identified 31 publications (148 pregnancies; 49 Parkinson's Disease, 2 Parkinsonism, 21 Dopa-Responsive Dystonia, 32 Restless Leg Syndrome, 1 Schizophrenia and 43 unknown indication) detailing treatment with levodopa, and 12 publications with dopamine agonists. Adverse outcomes included seizures and congenital malformations. Survey participation included patients (n=7), neurologists (n=35), PD Nurse Specialists (n=50), obstetricians (n=15) and midwives (n=20) and identified a further 34 cases of pregnancy in women with PD. Common themes for suggested management included: optimisation of motor symptoms, preference for levodopa monotherapy, and normal delivery unless indicated by obstetric causes.

Conclusions

This study demonstrates the paucity of evidence for decision-making in the medical management of PD during pregnancy. Collaboration is needed to develop a prospective registry, with longitudinal maternal and child health outcome measures, to facilitate consensus management guidelines.

Approximately 5% of Parkinson's Disease (PD) diagnoses are made in individuals <40 years, meaning that women with early-onset PD may become pregnant after diagnosis.(1) The incidence of pregnancy in women with PD is unclear, although it is likely to rise given the trend towards increasing maternal age and no data to date indicates a reduction in fertility for those women diagnosed with PD.(2) Previous case series have documented foetal and maternal outcomes in multiple pregnancies, including adverse events such as spontaneous abortion. However, information about the use and safety of medication for the treatment of PD during pregnancy is largely anecdotal and lacks long-term follow-up maternal and child outcome data. The lack of evidence-based practice and standardised clinical guidelines means clinicians and women with PD face uncertainty as to how best to plan care during this period. This study seeks to evaluate and summarise currently available evidence for the use of dopaminergic therapy during pregnancy, and to determine the experiences of both patients and clinical teams of the management of PD during pregnancy.

Methods

This study includes: i) a structured literature review of available evidence relating to the use of medication to treat PD during pregnancy, and ii) a survey of patient and clinical team experiences of PD management during pregnancy.

Literature Search

Our literature review aimed to address the obstetric outcomes when medication used to treat PD had been used during pregnancy, and to assess the quality of evidence against GRADE criteria. Reports meeting the following criteria were eligible for inclusion; i) those relating to the use of levodopa, dopamine agonist, MOA-B or COMT inhibitor, or anti-muscarinic therapy in pregnant women, irrespective of diagnosis, ii) an English language abstract, iii) data and observations from pregnancy in humans, rather than other mammalian species. To maximise reach, data relating to the

use of PD therapies in other dopamine-responsive conditions such as restless leg syndrome and dopa-responsive dystonia were also included. No restriction was placed on the date of publication, with information sourced using the MEDLINE and Web of Science databases. Additional articles were also identified from the reference list of screened articles. The database search strategy is summarised in supplementary Figure 1. Those articles included were subsequently divided into case reports, small case series (n<5), large case series (n>5), and larger observational studies (Supplementary Table 1). Information collated included: name or class of dopaminergic medication, number of pregnancies exposed, reason for treatment (maternal diagnosis), and pregnancy outcome. The GRADE criteria were used to assess the quality of evidence relating to each medication with the summary measure determined by the total number of live births, spontaneous abortions, terminations of pregnancy and still births which occurred with the use of each drug.

Survey data collection

Via an online survey, data were collected on five key domains: i) Medication to treat PD symptoms, ii) PD symptoms during pregnancy, iii) Organisation of clinical care, iv) Adverse obstetric events and delivery, v) Post-partum period. Informed consent was obtained from five groups: individuals diagnosed with PD who had been pregnant since diagnosis, neurologists, obstetricians, midwives and PD specialist nurses. The organisations involved in contacting these groups are summarised in Supplementary Figure 2. Healthcare professionals without previous clinical experience in this setting were also invited to share suggested management plans in order to gain a wider context of opinion.

Data analysis

Nominal and multiple-choice survey responses were analysed descriptively. Open text responses were coded according to content, and an inductive, data-driven coding approach employed. Content analysis identified key themes, and constant comparison enabled a search for emerging themes.

Results

Literature Review: Clinical evidence for the use of anti-parkinsonian medication during pregnancy

Supplementary Table 1 and Table 1 summarise the publications reviewed and outcomes respectively.(3,4,13–22,5,23–32,6,33–38,7–12) In brief, 31 publications reported the use of levodopa in 148 pregnancies, with examples of reported adverse outcomes including: congenital malformation (n=8) and seizures.[4-7] Two publications provided results of genetic testing, including a total of four cases with *Parkin* mutations.(21,22) Of the 109 levodopa-exposed pregnancies for which outcomes were available, 83% resulted in live births (n=91), 8% were electively terminated (n=9) and 9% resulted in spontaneous abortion (n=10). Fewer publications included use of dopamine agonists (n=12), anti-muscarinic medication (n=4), catechol-O-methyl-transferase (COMT) inhibitors (n=4), monoamine-oxidase B inhibitors (MOBI) (n=3) and deep brain stimulation (n=4). The largest case series of DBS during pregnancy identified 11 individuals with 18 births (PD=3, Dystonia=5, Tourette's Syndrome=2, Obsessive-Compulsive Disorder=1). Of the three cases diagnosed with PD, one stopped her medication during pregnancy and resumed at the same dose post-partum, another changed from a dopamine agonist to levodopa, and back to a dopamine agonist post-partum, and the third continued her treatment of a dopamine agonist and MAOI throughout.(21) None of these women breast fed in the post-partum period owing to concerns of the impact of their oral medical therapy. The quality of evidence is summarised according to the GRADE criteria (Table 2).

Survey Outcomes: Patients, Neurologists, PD Nurse Specialists, Obstetricians and Midwives

Our survey identified 34 pregnancies in women with PD, with medication continued in 15, and two reported complications (Table 2).

Women diagnosed with PD with subsequent pregnancy

Seven women completed our survey regarding 10 pregnancies, resulting in eight healthy live births, one stillbirth (24 weeks) and one pregnancy with unknown outcome (Table 2). Three women were

diagnosed with PD during pregnancy (20-48 years) and three women received oral medical therapy during 4 pregnancies. One patient reported an improvement in motor symptoms, despite withdrawal of all PD medications during this period. Two patients (2 and 6) required oral medical therapy post-partum due to worsening motor symptoms.

Neurologists

Thirty-five neurologists responded to our survey, eight of whom had experience caring for women with PD during 12 pregnancies (Table 3 and Supplementary Table 2). Management suggestions included reviewing medication safety and using as few medications as possible, particularly pre-conception and during the first trimester. Emphasis was placed on maintaining good motor symptom management during pregnancy, and if required, oral levodopa monotherapy was preferred. They also suggested regular review, referral to specialist movement disorder clinics during the antepartum period and close working with other members of the multi-disciplinary team.

PD Nurse Specialists

Fifty responses were obtained; five of whom had experience of caring for patients with PD during eight pregnancies (Table 3 and Supplementary Table 2). Suggestions focused on the antenatal period, including review of medication use and aiming to minimise oral medical therapy. There was wide support for adopting a multi-disciplinary approach (n=19). Suggestions for organisation of care included open-access to neurology services (n=1) and more frequent monitoring (n=6).

Obstetricians

Fifteen responses were obtained from obstetricians; two having had experience managing four pregnancies in mothers with PD (Table 3 and Supplementary Table 2). Twelve suggested obstetric-led care due to the unknown medication risk in pregnancy and the potential for worsening motor symptoms. There was consensus that a normal schedule of antenatal appointments should be

followed, with increased review if problems arose. Additional recommendations included: pre-pregnancy counselling, monthly joint clinics with the neurology team and co-ordination of antenatal appointments with foetal growth scans. None advised delivery by caesarean section, this being reserved for obstetric indications only. Suggestions for post-partum management included standard care, inpatient neurology review within 24-hours of delivery and obstetric high-dependency monitoring.

Midwives

Twenty midwives responded to the survey, none of whom had experience of caring for women with PD during pregnancy. Seventeen shared suggestions for pregnancy care (Supplementary Table 3). Antenatally, these included: obstetric-led care (n=7), multi-disciplinary team approach (n=8), involvement of physiotherapists to aid balance difficulties (n=4) and offering home visits to avoid long waits in antenatal clinics (n=2). Active, mobile labour was advised, although the potential for women to tire, guided by their experience of other chronic disorders, was highlighted alongside the midwifery preference for delivery in an obstetric unit or midwife-led unit alongside an obstetric centre.

Discussion

This study represents the first to synthesise evidence relating to clinical outcomes of the management of PD during pregnancy and investigate care experiences from patient and multi-disciplinary team perspectives.

Medication during pregnancy

Literature review:

Our literature review demonstrates the paucity of evidence for the safety of dopaminergic therapy during pregnancy, with levodopa the preferred form of treatment. Ten pregnancies, from a total of

148, resulted in spontaneous abortion (9.2%) and three live births were associated with foetal congenital abnormalities including, patent foramen ovale and ductus arteriosus.(3) Rates of clinically recognised pregnancies resulting in foetal loss in the general population are estimated to be 10-24%, indicating no excess rate amongst this patient group, and particularly in the context of exposure to levodopa therapy.(41)Fewer studies related to the use of dopamine agonists, anti-muscarinics and COMT and MOA-B inhibitors during pregnancy, and therefore estimates of foetal loss are more difficult to determine. Spontaneous abortion was reported in four cases of pramipexole monotherapy.(3,42)

Our literature search also included data relating to the use of medication in the treatment of other dopamine-responsive disorders during pregnancy such as Restless Legs Syndrome (RLS) and Dopa-Responsive Dystonia (DRD). The underlying aetiology of these disorders is distinct from that of PD and may independently impact pregnancy irrespective of medication. There was substantial variation in the dose of all prescribed medication (Table 1) and understanding of the risk of obstetric complications is limited by the majority of evidence provided in the form of case reports. Furthermore, PD medications were frequently co-prescribed, making it difficult to elucidate the effects of individual drugs. Four publications relating to the use of deep brain stimulation during 23 pregnancies were also identified (Supplementary Table 1). All operations were undertaken pre-pregnancy with 23 live births and one spontaneous abortion in the first few weeks of pregnancy reported. No complications with the use of DBS during pregnancy were reported.

Multi-disciplinary survey outcomes

Our survey found 88.2% (n=30/34) of the identified pregnancies resulted in a live birth, and 5.9% (n=2/34) ended in spontaneous abortion, below estimated rates in the general population.(41) Where medication was continued, there was a preference for levodopa. However, these results are

retrospectively reported, and due to recruitment methods, potentially not representative of the spectrum of women diagnosed with PD who have subsequently become pregnant.

Parkinson's symptoms during pregnancy

Published literature to date suggests that women experience variation in their PD symptoms during pregnancy, with early reports suggesting that 65% of women experienced worsening of their symptoms, in spite of the continuation of medical therapy.(12) The physiological mechanisms by which pregnancy can result in symptomatic change is poorly understood. Altered pharmacokinetics due to the expansion in plasma volume may reduce peak serum concentrations of oral medical therapy, while changes to gastrointestinal absorption and increases in eGFR may affect the availability and renal elimination of drugs.(43) In keeping with this, our survey identified variation in the evolution of motor symptoms during the course of pregnancy, although this may have related to a number of factors, including ongoing adjustments to the dose of medical therapy for which no serum measurements were available.(1)

Half of the women surveyed noted worsening of symptoms during pregnancy, thirteen reported no change and one patient reported an overall improvement in motor symptoms, mood and energy levels during two pregnancies. Where symptoms worsened, 60% (n=9) did so after all or adjuvant medications were withheld or doses reduced, while 25% (n=4) noted symptom worsening while receiving treatment with levodopa monotherapy. Only 15% (n=2) of women whose symptoms worsened did so despite no change to PD medications. These reports suggest that although PD symptoms during pregnancy are likely to vary between individuals, the maintenance of at least pre-pregnancy treatment levels is likely to limit symptomatic fluctuation.

Organisation of care

Studies of other chronic disorders (e.g. rheumatoid arthritis) in pregnancy emphasise the need for well-coordinated multidisciplinary involvement, with decision aids demonstrating enhanced shared decision making.(44) In spite of this, there are no currently available guidelines on obstetric best practice in the management of PD during pregnancy, and only two patients in this cohort received more frequent antenatal neurology input. All of the obstetricians consulted felt that antenatal care should be consultant-led and follow a normal schedule of antenatal appointments. Although joint obstetric/neurology review was only undertaken in three cases in this study, both clinician groups advocated enhanced communication between teams.

Adverse events and delivery

To date, there is no evidence to suggest higher rates of foetal or maternal complications, fertility difficulties or birth related complications in women with PD.(1) Obstetrician responses in this survey felt there was no indication to alter the standard of post-partum care (4/15 (27%)) and that a diagnosis of PD would not contra-indicate vaginal delivery, suggesting that delivery by caesarean section should be reserved for obstetric indications only. Information relating to the mode of delivery was available for 12 pregnancies; eight vaginal deliveries, two emergency caesarean sections (17%) and two assisted deliveries (17%). The rate of emergency section is ~15% in the UK, broadly comparable to that observed in our data set.(45)

Post-partum period, breastfeeding and support

The challenges facing new mothers with PD are poorly understood, with deteriorating fine motor skills often presenting functional difficulties in undertaking daily tasks. Decisions relating to breast-feeding are complicated by limited information regarding the potential risk of medication to infants, although plasma and breastmilk levodopa concentrations in a single study estimated the level of exposure to be low (0.016-0.023mg/kg/day).(24) The inhibitory effects of levodopa and dopamine

agonists on prolactin synthesis suggests they may suppress lactation, although two women in this cohort were able to breastfeed for a limited time.

Conclusion

This study has collated information from a number of distinct sources, highlighting several key aspects. The majority of outcome data for pregnancies of women diagnosed with PD are linked with use of levodopa treatment during this period, with outcome data only available in a small number of cases for those treated with other forms of dopaminergic therapy. Results from our systematic review indicate no excess rate of miscarriage, stillbirth or congenital deformity amongst this patient group compared to the general population. Patient and MDT survey responses suggest that an optimised care plan would include close co-operation between neurology and obstetric teams during pregnancy and delivery. However, the most important element highlighted is the need for an international prospective registry for women diagnosed with PD during and after pregnancy, similar to those for other chronic neurological disorders. A registry would aid in the development of consensus guidelines for clinical care in this setting and provide longer-term follow-up data on infant and childhood development to better aid therapeutic decision-making.

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Authors' Roles

1. Research project: A. Conception, B. Organization, C. Execution;
2. Statistical Analysis: A. Design, B. Execution, C. Review and Critique;
3. Manuscript: A. Writing of the first draft, B. Review and Critique.

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Ethical Compliance Statement

Ethical approval for this study was provided by Cardiff University School of Medicine Research Ethics Committee (Reference: 18/05). Informed consent was obtained from all participants in this study, including both patients and clinical team members. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this work is consistent with those guidelines.

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Supplementary Figure Legends

Supplementary Figure 1: Schematic representation of the search terms used during the systematic literature review. Blue boxes represent the research terms used and number of publications identified. Green boxes represent additional publications identified, and orange boxes those excluded as not considered relevant to this review. Articles were divided into case reports (n=1), smaller case series (n<5), and larger case series or cohort studies (n>5). COMT inhibitor: catechol-O-methyl-transferase inhibitor, MAOI: monoamine-oxidase inhibitors.

Supplementary Figure 2: Schematic representation or sources of participant recruitment from clinical and patient sectors. Green: patient recruitment, Orange: Neurology recruitment, Blue: Parkinson's Disease Nurse Specialist Recruitment, Yellow: Midwifery recruitment, Purple: Obstetric recruitment.

Table 1: Outcomes following in utero exposure to Parkinson's medications in the treatment of neuro-psychiatric disorders

In utero exposure to Parkinson's medication						
No pregnancies	**Indication**	**Drug**	**Range maximum dose (mg/day)**	**Duration exposure (weeks)**	**Pregnancy outcome**	**Complications**
In utero exposure to Levodopa						
Case reports: 22 publications						
32 pregnancies	26 PD, 2 P 4 DRD	*levodopa preparations*	100- 1500 No data (12)	6-40 No data (3)	31 live births (4 prem) 2 SA	Neonate seizure 1 hr post-partum., Placental abruption, VSD in 1 twin., PPROM in 2 pregnancies
Small case series: 3 publications						
12 pregnancies	9 PD, 3 DRD	*Levodopa preparations*	1250-4000	36 No data (9)	10 live births, 2 SA	
Large case series and observational studies: 6 publications						
104 pregnancies	14 PD, 14 DRD, 32 RLS 1 Psych, No data (43)		100-400 No data (52)	12-36 No data (52)	50 live births (8 prem), 6 SA, 9 TOP 2 LTF, No data (37)	3 minor anomalies (PFO+PDA, talipes varus, nasal deformity), 1 pre-eclampsia. 1 premature infant developed foetal distress during labour, eventually resolved.
Total pregnancies: 148					**91 live births, 10 SA, 9 TOPs, 2 LTF, 37 no data**	
In utero exposure to dopamine agonists						
Case reports: 9 studies						
10 pregnancies	10 PD	PRAM (3), PER (1), CAB (2), ROP (2), B ROM (2)	0.75-4.5 3 1-4 1.5-1.88 20-25	29-36+	11 live births (4 prem)	1 placental abruption, VSD in 1 twin, 1 neonate seizure 1 hr post-partum.
Large case series and observational studies: 3 studies						
151 pregnancies	1 DRD, 20 RLS, 13 PD 117 no data	BROM (20) PRAM (84) CAB (31) ROP (10) ROT (2) APOM (1) PIRI (3)	No data 1.125-4.5 No data 8-6 No data No data 100-300	3-36+	4 SA, 1 TOP, 31 live births (6 prem) inc 2 pairs of twins. 1 subsequent neonatal death due to liver enzyme deficiency.	1 neonatal death. 1 prem infant developed foetal distress during labour, eventually resolved. 1 small for gestational age
Total pregnancies: 161			**42 live births (inc 3 pairs of twins) and 1 subsequent neonatal death, 4 SA, 1 TOP, 117 no data**			
In utero exposure to anti-muscarinics						

Case reports: 4 publications						
7	2 dystonia , 4 SCZ, 1 PD	TRI	2-50	36-42	6 healthy neonates. 1 SA.	
In utero exposure to COMT inhibitors						
Case reports: 4 publications						
4	4 PD	ENTA	200-700	12-36	5 live births (inc twins)	1 neonate seizure 1 hr post-partum. PPROM in twin pregnancy with EMCS at 35 weeks. Small VSD in 1 twin.
In utero exposure to MAO inhibitors						
Case reports: 2 publications						
2	2 PD	SELE	7.5, 10	29-40	3 live births (inc twins)	PPROM at 35 weeks with EMCS. Small VSD in one twin.
Large case series: 1 publication						
7	7 PD	RASA	1	4-36+	7 live births (2 prem). 1 neonatal death.	1 Neonatal death of a twin due to liver enzyme deficiency.
In utero exposure to DBS						
Case reports: **1 publication**						
1	Dystonia			Used throughout gestation	1 live birth	
Small case series: 1 publication						
4	Dystonia			Used throughout gestation	4 live births	Intrauterine growth retardation in one pregnancy
Large case series: 2 publications						
18	PD, Dystonia, TS, OCD			Used throughout gestation	18 live births (inc twins), 1 SA	

Legend: *36+ denotes levodopa exposure for full duration of pregnancy with term delivery, where exact gestational age at delivery is unavailable.
AD= assisted delivery, APOM= Apomorphine, BROM= bromocriptine, CAB= cabergoline, DRD= Dopa-responsive Dystonia, ELCS= elective caesarean section, EMCS= emergency caesarean section, ENTA= entacapone, HPL= hyperprolactinaemia, LTF=lost to follow-up, MSA= multiple system atrophy, **OCD=Obsessive-Compulsive Disorder,** P= Parkinsonism, PD= Parkinson's disease, PDA=patent ductus arteriosus¸ PER= pergolide, PFO= patent foramen ovale, PRAM= pramipexole, PPROM= preterm premature rupture of membranes, RLS= restless leg syndrome, ROP= ropinirole, ROT= rotigotine, SA= spontaneous abortion, SCZ= schizophrenia, SD= Segawa disease, SELE= selegiline, SGA= small for gestational age, TOP= termination of pregnancy, TRI= trihexyphenidyl, **TS=Tourette's Syndrome,** VSD= ventricular septal defect

Table 2: GRADE quality of evidence

Drug	Number of Studies/ Pregnancies	Design	Quality	Consistency	Directness	Overall quality
Levodopa preparation	31 studies, 148 pregnancies	Case reports: 22 (32 pregnancies) Small case series: 3 (12 pregnancies) Large case series: 4 (25 pregnancies) Observational studies: 2 (80 pregnancies)	Predominantly case studies or case series; limited generalisability, Observational studies are based on data from drug registries; no control group for comparison. Many studies lack data re: drug dose and duration.	Case report/series have largely consistent positive outcomes– no major foetal abnormalities reported with levodopa use.	Outcome reasonably measure direct; foetal health and absence of malformation ~ safety of L-Dopa in pregnancy. > 51/143 patients treated for conditions other than PD- likely require lower doses of L-Dopa; Limited infant follow-up- adverse effects may not become apparent until later life	**Low– further research is likely to have an important impact on confidence in the safety of levodopa in pregnancy.**
Dopamine agonists	12 studies, 161 pregnancies	Case reports/small case series: 9 (10 pregnancies) Large case series/observation studies: 3 (151 pregnancies)	Case reports provide limited generalisability, cannot comment on causality.	Case reports have largely consistent positive outcomes. No major foetal abnormalities reported.	Outcome measure direct; foetal health and absence of malformation ~ safety of DA in pregnancy. Limited infant follow-up- adverse effects may not become apparent until later life.	**Very low –any estimate of safety is very uncertain.**
Anti-muscarinics	4 studies, 7 pregnancies	Case reports/small case series: 4 (7 pregnancies)	Limited generalisability, cannot comment on causality.	Too few studies to comment on consistency.	Outcome measure direct; foetal health and absence of malformation ~ safety of anti-muscarinics in pregnancy. Limited infant follow-up- adverse effects may not become apparent until later life.	**Very low- any estimate of safety is very uncertain.**
COMT inhibitors	4 studies, 4 pregnancies.	Case reports/small case series: 4 (4 pregnancies)	Limited generalisability, cannot comment on causality.	Too few studies to comment on consistency.	Outcome measure direct; foetal health and absence of malformation ~ safety of COMT inhibitors in pregnancy. Limited infant follow-up- adverse effects may not become apparent until later life.	**Very low- any estimate of safety is very uncertain.**
MAO inhibitors	3 studies, 9 pregnancies.	Case reports/small case series: 2 (2 pregnancies) Large case series: 1 (7 pregnancies)	Limited generalisability, cannot comment on causality.	Too few studies to comment on consistency.	Outcome measure direct; foetal health and absence of malformation ~ safety of COMT inhibitors in pregnancy. Limited infant follow-up- adverse effects may not become apparent until later life.	**Very low- any estimate of safety is very uncertain.**
Deep Brain Stimulation	4 studies, 23 pregnancies	Case reports/small case series: 2 (5 pregnancies) Large case series: 2 (18 pregnancies)	Limited generalisability, cannot comment on causality.	Too few studies to comment on consistency.	Outcome measure direct; foetal health and absence of malformation ~safety of DBS in pregnancy. Limited infant follow-up- adverse effects may not become apparent until later life.	**Very low- any estimate of safety is very uncertain**

Table 3. Neurologist (A) PD Nurse Specialist (B), Obstetrician (C), and patient (D) experiences of Parkinson's Disease during pregnancy

Case No.	No of cases	Aware of plans to conceive	Informed of pregnancy (trimester)	Parkinson's medication in pregnancy			PD symptoms during pregnancy a) Motor b) Non-motor	PD symptoms post-partum a) Motor b) Non-motor	Obstetric outcomes	Antenatal organisation and provision of care a) Communication between obstetrics & neurology b) Joint obstetric-neurology review	Post-partum organisation and provision of care a) Neurology informed of birth b) Inpatient neurology review
				Medication during pregnancy	Medication changes during pregnancy	Post-partum medication change					
A. Neurologists											
1	1	N	-	-	No change	-	a) No change b) No change	a) No change b) No change	Live birth	a) Yes b) No	a) Yes b) Yes
2	1	N	1st		No change		a) No change b) No change	a) No change b) No change	Live birth	a) Yes b) Yes	a) N/A b) N/A
3	5	Y	1st	Levodopa alone (3) Withheld all medications (2)	Levodopa increased (1)	Return to usual regimen	a) Generally worse b) 1 patient became depressed	a) No change b) Mood changes	Live births	a) Yes b) Yes (2 cases), No (3 cases)	a) Yes b) Yes (2 cases)
4	1	Y	1st		No change	No change	a) No change b) No change	a) No change b) No change	Live birth (twins)	a) Yes b) No	a) No b) No
5	1	N	1st	-	No change	No change	a) No change b) No change	a) N/A b) N/A	TOP	a) No b) No	a) N/A b) N/A
6	1	N	1st	Stalevo 300-400mg /day	No change	Stalevo 400-500mg/ day	a) Bradykinesia worse b) No change	a) Bradykinesia improved b) No change	Live birth	a) Yes b) No	a) No b) No
7	1	N	1st	Levodopa	Initially stopped, re-started.	No change	a) Worse without medication b) No change	a) No change b) No change	Live birth	a) Yes b) No	a) No b) No
8	1	N	1st	**-**	No change	No change	a) No change b) Psychiatric symptoms	a) No change b) No change	Live birth	a) Yes b) No	a) No b) No
B. PD Nurse Specialists											
1	1	Y	1st	All stopped except Sinemet 6.25mg tds	No change	N/A	a) No change b) No change	a) N/A b) N/A	SA 12 weeks	a) Yes b) -	a) – b) N/A
2	2	N	2nd	Madopar 100/25 tds	No change	No change	a) No change b) No change	a) No change b) No change	Live birth	a) Yes b) Yes	a) Yes b) No

3	2	Y + N	1st in both	1 stopped meds pre-conception, 1 reduced pramipexole.	No change	Return to usual regimen	a) No change b) No change	a) Increased bradykinesia and off symptoms b) Anxiety, poor sleep	Live births	a) Yes b) Joint review with midwife. Found midwife disinterested in birth plan.	a) No b) No
4	1 (2P)	N	2nd	Levodopa. Cabergoline withheld.	Levodopa increased.	Cabergoline restarted (6 weeks).	a) No change b) No change	a) No change b) No change	Live births	a) Yes b) No	a) Yes b) Yes
5	1	N	1st	Dopamine agonist withheld.	No change.	Nil	a) Bradykinesia, b) Fatigue.	a) No change b) No change	Live birth	a) Yes b) No	a) No b) No

C. Obstetricians

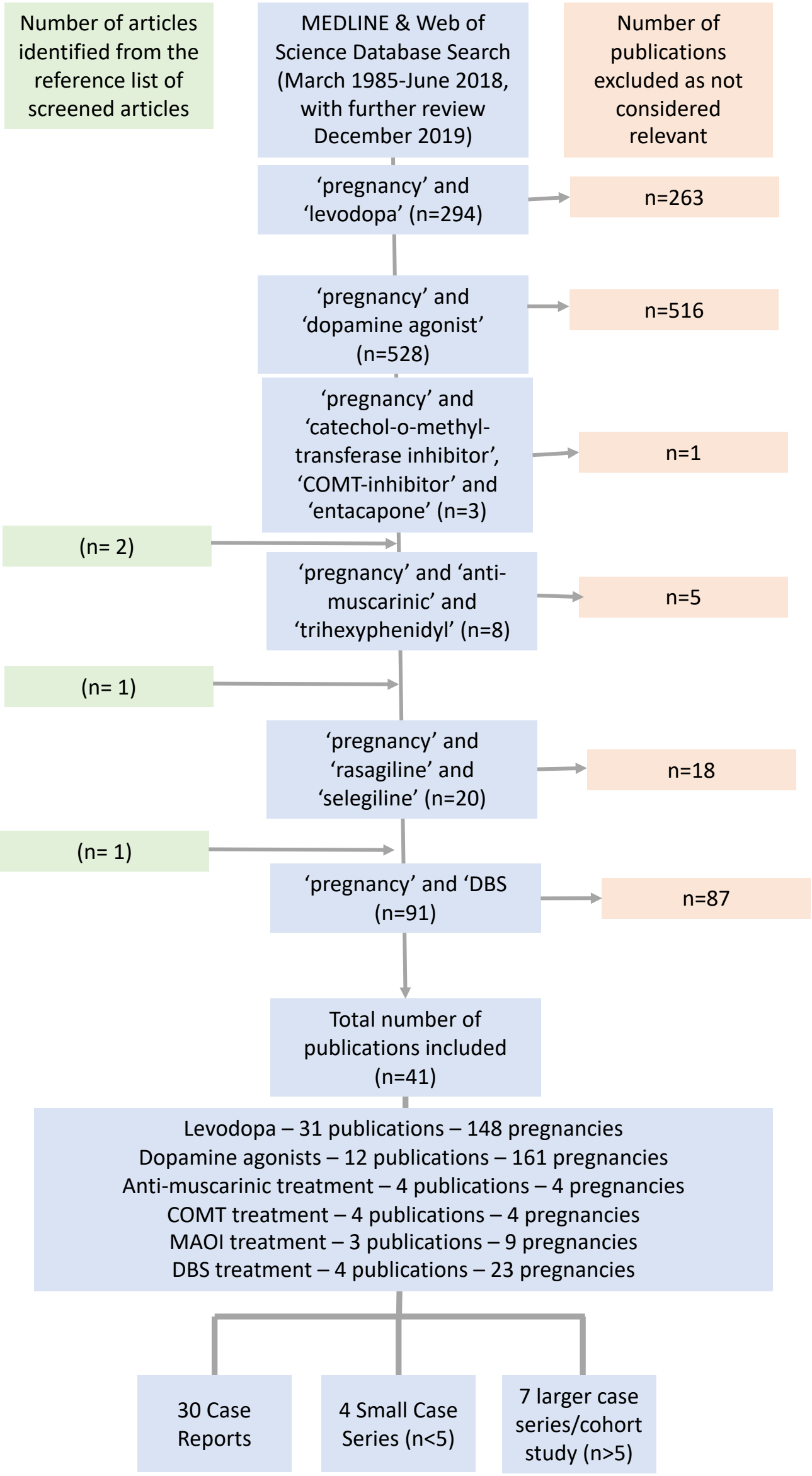
Case No.	No of cases	Stage of first involvement	Frequency of obstetric review	Change to regular schedule of antenatal obstetric care	Joint obstetric-neurology antenatal review a) Joint review undertaken b) Would joint review be helpful?	Obstetric outcome	Immediate post-partum care a) Inpatient neuro review b) Breastfeeding c) Length of hospital stay	Post-partum outpatient obstetric review
1	2	Pre-conception 1st	3-4 times	More frequent antenatal clinic review	a) Yes, b) Yes; 'spare the women additional trips to hospital'	Live births, VD. No complications	a)No, b)Unable, c) <3 days	a) No outpatient obstetric review
2	2	2nd trimester	Twice	Increased visits, serial growth monitoring	a) No, b) Yes; *'allow discussion between obstetrics and neurology'*	Live births, VD. No complications	a) Yes, b) – c) 4 days	a) No outpatient obstetric review

D. Women diagnosed with PD

Case No.	Patient demographic	Pregnancy management a) Medication, b) PD symptoms during pregnancy	Obstetric outcomes	Pregnancy care a) Provision of antenatal care b) Frequency of antenatal neurology review	Support and information a) Level of support from healthcare team, b) Provision of information during pregnancy	Post-partum a) Breastfeeding, b) Attendance at mother and baby groups, c) Attendance at PD support groups, d) Medication change post-partum
1	Diagnosed at 20 years, G1P1, FH -	a) No change, Levodopa/carbidopa during pregnancy b) No change.	Live birth. EMCS, 37 weeks.	a) Consultant-led, b) No change	a) Well-supported, b) Inadequate	a) Breastfed for 8 weeks, b) Attended , c) Did not attend, d) No change
2	Diagnosed at 29 years, G2P2, FH +	a) No change. Cannot recall for 1st pregnancy. Requip XL in 2nd pregnancy, b) General worsening of motor symptoms.	Live birth. Live birth. VD, 36 weeks.	a) Consultant-led, b) No change (6 monthly)	a) Well-supported, b) Adequate	a) Not breastfed, b) Attended, c) Did not attend, d) Dose increased
3	Diagnosed at 25 years, G2P?*, FH +	a) Sinemet, Rasagiline, Ropinirole withheld. No medications taken. b) Improvement in motor symptoms, mood and energy. Most noticeable in 2nd trimester.	Live birth. VD, 39 weeks. Admitted week 38. Neonatal hypoglycaemia post-partum; stayed 1 week in hospital.	a) Consultant-led, b) No change (seen once during pregnancy)	a) Poorly supported, b) Inadequate	a) Breastfed for 1 week. Stopped to re-start medication, b) Attended, c) Did not attend
4	Diagnosed at 44 years, G1P1, FH -	a) None taken- no regular medication, b) PD presented during pregnancy and worsened in 2nd trimester.	Live birth. EMCS, 35 weeks. HELLP syndrome. Infant in NICU for 24 hrs.	a) Midwife-led, b) No formal diagnosis until post-partum	a) Well-supported, b) Inadequate	a) Not breastfed, b) Attended, c) Did not attend

5	Diagnosed at 26 years, G2P1, FH -	a) Cabergoline and orphenadrine withheld. Madopar 50/12.5mg during pregnancy b) Increased tremor.	Stillbirth, 24 weeks Live birth. AD, full term	a) Midwife-led, b) More frequent (seen 3 times)	a) Unsure, b) Inadequate	a) Not breastfed, b) Did not attend, c) Did not attend, d) Resumed medication
6	Diagnosed at 33 G1P1, FH -	a) No regular medication and none during pregnancy. PD diagnosed in early pregnancy. b) Worsening bradykinesia, UL tremor, dexterity, sialorrhoea. Most marked 3rd trimester	Live birth. VD, 41 weeks. Maternal pyrexia post-partum; given IV antibiotics overnight.	a) Consultant-led b) First neurology consultation at 14 weeks; seen several times thereafter	a) Well-supported b) Unsure	a) Not breastfed. b) Attended c) Attended d) Sinemet initiated
7	PD Diagnosed at 48 G1P1, FH -	a) No regular medication. PD diagnosed post-partum. b) Worsening; tremor in 1st and 3rd trimesters. Micrographia.	Live birth. AD, 40 weeks. Neonatal respiratory difficulties- infant in NICU for 36 hrs.	a) Consultant-led b) First neurology consultation at 12 weeks; no regular neurology review during pregnancy. Formal diagnosis post-partum	a) Well-supported. b) Inadequate	a) Breastfed for 8 months. Stopped to start medication b) Attended c) Did not attend

Legend: *outcome of second pregnancy not specified by respondent, G= gravidity, P= parity, eg. G1P1 = gravida 1, para 1, AD= Assisted delivery, EMCS= emergency caesarean section, FH= family history, HELLP syndrome= haemolysis, elevated liver enzymes, low platelets syndrome, NICU= neonatal intensive care unit, VD= vaginal delivery


Number of articles identified from the reference list of screened articles
MEDLINE & Web of Science Database Search (March 1985-June 2018, with further review December 2019)
Number of publications excluded as not considered relevant
'pregnancy' and 'levodopa' (n=294)
n=263
'pregnancy' and 'dopamine agonist' (n=528)
n=516
'pregnancy' and 'catechol-o-methyl-transferase inhibitor', 'COMT-inhibitor' and 'entacapone' (n=3)
n=1
(n= 2)
'pregnancy' and 'anti-muscarinic' and 'trihexyphenidyl' (n=8)
n=5
(n= 1)
'pregnancy' and 'rasagiline' and 'selegiline' (n=20)
n=18
(n= 1)
'pregnancy' and 'DBS (n=91)
n=87
Total number of publications included (n=41)
Levodopa – 31 publications – 148 pregnancies
Dopamine agonists – 12 publications – 161 pregnancies
Anti-muscarinic treatment – 4 publications – 4 pregnancies
COMT treatment – 4 publications – 4 pregnancies
MAOI treatment – 3 publications – 9 pregnancies
DBS treatment – 4 publications – 23 pregnancies
30 Case Reports
4 Small Case Series (n<5)
7 larger case series/cohort study (n>5)

Supplementary Tables

Supplementary Table 1: Details of publications identified in Systematic Literature Review

Author	Year of publication	Cohort size – patients (pregnancies)	Diagnoses	Medications used	Adverse outcomes
Levodopa					
Allain, H. et al. (1)	1989	1(1)	PD	Levodopa	
Asha, B. et al. (2)	2010	1(1)	PD	Levodopa	
Ball, M. C. et al. (3)	1995	1(1)	P	Levodopa	AD- delayed 2nd stage. No complications.
Basile, S. et al. (4)	2017	1(1)	PD	Levodopa	
Campos-Sousa, R. N. et al (5)	2008	1(8)	PD	Levodopa	
Cook, D. G. et al. (6)	1985	2(3)	PD	Levodopa	
De Mari, M. et al. (7)	2002	1(1)	PD	Levodopa	
Dostal, M. et al. (8)	2013	42(43)	PD, RLS, SD, DRD, Suicide attempt	Levodopa	3 SA. 7 pre-term deliveries. 3 minor anomalies (PFO+PDA, talipes varus, nasal deformity).
Golbe, L. I. (9)	1987	5(6)	PD	Levodopa	1 pre-eclampsia
Ha, D. E. et al. (10)	2007	1(1)	PD	Levodopa	Pre-term delivery. PPROM at 26 and 31 weeks with EMCS at 32 weeks
Hagell, P. et al. (11)	1998	1(1)	PD	Levodopa	
Jacquemard, F. et al. (12)	1990	1(1)	PD	Levodopa	
Kallen, B. et al. (13)	2013	37(37)	-	Levodopa	
Kanzato, N. et al. (14)	2006	1(1)	PD	Levodopa	
Kupsch, A. et al. (15)	1998	1(1)	PD	Levodopa	
Lindh, J. (16)	2007	1(1)	PD	Levodopa	Neonate seizure 1 hour post-partum.
Nomoto, M. et al. (17)	1997	1(3)	DRD	Levodopa	SA at 6 and 12 weeks.
Nygaard, T. G. et al. (18)	1991	3(3)	DRD	Levodopa	
Routiot, T. et al. (19)	2000	1(1)	PD	Levodopa	
Scott, M. et al. (20)	2005	1(2)	PD	Levodopa	Pre-term delivery by EMCS-placental abruption at 32 weeks
Scelzo, E. et al. (21)	2015	3(6)	PD	Levodopa	2 SA
Serikawa, T. et al. (22)	2011	1 (1,twins)	PD	Levodopa	Pre-term delivery by EMCS-PPROM at 35 weeks. Small VSD in one twin.
Shulman, L. M. et al. (23)	2000	1(1)	PD	Levodopa	
Thulin, P. C. et al. (24)	1998	1(1)	PD	Levodopa	
Tüfekçioğlu, Z. et al. (25)	2018	5(5)	PD	Levodopa	1 pre-term delivery by CS at 35 weeks, infant developed foetal distress during labour, eventually resolved.

von Graevenitz, K. S. et al. (26)	1996	6(6)	-	Levodopa	1 SA
Ward, V. D. (27)	2018	1(1)	PD	Levodopa	
Watanabe, T. et al. (28)	2009	6(8)	SD	Levodopa	2 SA
Watanabe, T. et al. (29)	2012	1(1)	SD	Levodopa	
Zhu, L. et al. (30)	2011	1(1)	MSA	Levodopa	
Zlotnik, Y. et al. (31)	2014	1(1)	PD	Levodopa	Faltering growth at 13 months post-partum.
Dopamine agonists					
Asha, B. et al. (2)	2010	1(1)	PD	ROP	
Benbir, G. et al. (32)	2014	1(1)	PD	PRAM	Premature delivery at 35 weeks.
Benito-León, J. et al. (33)	2001	1(1)	PD	BROM	
De Mari, M. et al. (7)	2002	1(1)	PD	PER	
Dostal, M. et al. (8)	2013	21(21,twins)	RLS, SD	PRAM, ROT, ROP	3 SA, 3 premature deliveries, 1 SGA
Kallen, B. et al. (13)	2013	117(117)	-	BROM, PRAM, APOM, CAB	
Lamichhane, D. et al. (34)	2014	1(1)	PD	PRAM	
Lindh, J. (16)	2007	1(1)	PD	BROM	Neonate seizure 1 hour post-partum
Mucchiut, M. (35)	2004	1(1)	PD	PRAM	
Scott, M. et al. (20)	2005	1(2)	PD	CAB	Pre-term delivery at 32 weeks by EMCS for placental abruption.
Serikawa, T. et al. (22)	2011	1(1, twins)	PD	ROP	Pre-term delivery by EMCS at 35 weeks for PPROM. Small VSD in one twin.
Tüfekçioğlu, Z. et al. (25)	2018	12(13, twins)	PD	PRAM, PIRI, ROP	1 SA, 3 premature deliveries. Neonatal in 1 twin death due to liver enzyme deficiency. 1 prem infant developed foetal distress during labour, eventually resolved.
Anti-muscarinics					
Goyal, S. et al. (36)	2017	1(1)	SCZ	TRI	
Mendhekar, D. N. et al. (37)	2011	1(3)	SCZ	TRI	
Robottom, B. J. et al. (38)	2011	1(2)	Dystonia	TRI	
Scelzo, E. et al. (21)	2015	1(1)	PD	TRI	SA
COMT inhibitors					
Basile, S. et al. (4)	2017	1(1)	PD	ENTA	
Lindh, J. (16)	2007	1(1)	PD	ENTA	Neonate seizure 1 hour post-partum.
Serikawa, T. et al. (22)	2011	1(1, twins)	PD	ENTA	Pre-term delivery by EMCS at 35 weeks due to PPROM. Small VSD in one twin.

Tüfekçioğlu, Z. et al. (25)	2018	1(1)	PD	ENTA	
MOA inhibitors					
Kupsch, A. et al. (15)	1998	1(1)	PD	SELE	
Serikawa, T. et al. (22)	2011	1(1, twins)	PD	SELE	Pre-term delivery by EMCS at 35 weeks due to PPROM. Small VSD in one twin.
Tüfekçioğlu, Z. et al. (25)	2018	7(7, twins)	PD	RASA	2 pre-term deliveries. 1 neonatal death of a twin pregnancy due to liver enzyme deficiency.
DBS during pregnancy			indication		outcome
Ziman.N et al. (39)	2016	6 (6.twins)	DYSTONIA		7 live births, inc twins. 1premature delivery at 35 weeks.
Park H et al. (40)	2017	1(1)	DYSTONIA		Live birth by ELCS at 38 weeks.
Scelzo E et al. (21)	2015	11(12)	3 PD, 5 DYSTONIA, 2 TS, 1 OCD		11 live births at term; 3 VD, 9 CS. 1 SA.
Paluzzi A et al. (41)	2006	3(4)	DYSTONIA		4 live births

AD= assisted delivery, APOM= Apomorphine, BROM= bromocriptine, CAB= cabergoline, CS= caesarean section DRD= Dopa-responsive Dystonia, ELCS= elective caesarean section, EMCS= emergency caesarean section, ENTA= entacapone, HPL= hyperprolactinaemia, LTF=lost to follow-up, MSA= multiple system atrophy, OCD=obsessive compulsive disorder, P= Parkinsonism, PD= Parkinson's disease, PDA=patent ductus arteriosus, PER= pergolide, PFO= patent foramen ovale, PRAM= pramipexole, PPROM= preterm premature rupture of membranes, RLS= restless leg syndrome, ROP= ropinirole, ROT= rotigotine, SA= spontaneous abortion, SCZ= schizophrenia, SD= Segawa disease, SELE= selegiline, SGA= small for gestational age, TOP= termination of pregnancy, TRI= trihexyphenidyl, TS= Tourette's syndrome, VSD= ventricular septal defect

Supplementary Table 2: Summary of questionnaire free text responses

A. Neurology suggested care	
Medication during pregnancy	*'I would review the potential of teratogenicity of the drugs the patient was taking and utilize the safest combination of medication for mother and child.'* ***N3*** *'I would make sure that all therapies are optimised, to ensure Mum is as fit as possible but would balance this with lowest drug doses to achieve this'* ***N17*** *'I would focus on treatment with L-dopa and try to minimise other drugs preferably from before conception to around 12 week.'* ***N1*** *'I probably would continue the levodopa, and if possible, use monotherapy.'* ***N18*** *I would check with senior pharmacists, medical obstetricians and do a literature search for evidence on best practice.'* ***N8*** *'[manage] On an individual basis, adhering to guidelines where possible'* ***N31*** *'Consult the following sourced of information: 1) Movement Disorder Specialist, 2) Hospital Pharmacist, 3) the medical literature'* ***N29*** *'I suspect there isn't a great deal of data. That said, methyl dopa is used for hypertension in pregnancy and I suspect the L-dopa preparations are the safest'* ***N33***
Communication	*'Would check the safety of PD drugs on developing baby and discuss with patient.'* ***N16*** *'Early meeting to review meds, meeting during preg to discuss delivery and post-natal care'* ***N30*** *'Explain that pregnancy is generally safe in PD'* ***N9***
Antenatal review	*'Referral to specialist md clinic.'* ***N25*** *'I would ensure regular PD nurse and movement disorders consultant review and liaison with Obstetrics'* ***N3*** *'speak with their midwife and a PD CNS'* ***N26*** *'close liaison with obstetrician and midwife.'* ***N30*** *'I would check with senior pharmacists'* ***N8*** *'I would seek specialist input from a Parkinson's/movement disorders expert'* ***N35***
Delivery and post-partum care	*'Ultimately, I would want to have a plan for the birth if it looks like it may be complicated, e.g. ensuring it's at a site with neurology cover.'* ***N26*** *'meeting during preg to discuss delivery and post-natal care'* ***N30***
B. PD Nurse Specialist suggested care	
Use of medication during pregnancy	*'Read up on medications via Electronic Medicines Compendium and local Trust guidelines/NICE best practice'* ***PDNS 37*** *'I would gain more info re medication that can be taken during pregnancy'* ***PDNS 14*** *'check the BNF regarding medications'* ***PDNS 27*** *'I have no experience and with no guidelines, I would try and keep medication to a minimum.'* ***PDNS 12*** *'Discuss with patient need for medication decide if could wean off dopaminergic therapy if taking low doses.'* ***PDNS 8*** *'Minimise medication as much as possible. If possible, remove all but levodopa'* ***PDNS 11*** *'Maintain stability, don't introduce any new treatments'* ***PDNS 31***

Multi-disciplinary working	*'Liaise closely with Neurologist in our service who specialises in maternal medicine and a midwife who works with him…Work with speciality midwife re symptom management.'* ***PDNS 7*** *'In very close coordination with the patient, Consultant and GP'.* ***PDNS 36*** *'As this is an area where I have no previous experience, I would liaise closely with the patient's neurologist in order to develop a management plan with an agreed plan of ongoing monitoring.'* ***PDNS 15*** *'MDT approach to include Neurologists midwives, physiotherapy. Closer monitoring'* ***PDNS 23*** *'Having no experience, I would d be asking other PDNS for information'* ***PDNS 9*** *'Ask local group/ PDNSA for any experience/advice.'* ***PDNS 10*** *'I would contact colleagues who've had experience in this area and would be guided by their knowledge & experience'* ***PDNS 20*** *'Same as epilepsy. In the same manner my colleague does with patients with epilepsy who are pregnant.'* ***PDNS 6*** *'In close collaboration with their consultant neurologist and obstetrician.'* ***PDNS 16*** ***"****MDT approach'* ***PDNS 32*** ***'****Liaise with obstetric team.'* ***PDNS 8*** *'I would seek advice from multi-professional team and Neurologist.'* ***PDNS 37*** *'see if I could arrange joint working with a midwife'* ***PDNS 27*** *'Jointly with consultant. Be available to midwife to discuss'* ***PDNS 34*** *'Liaise with midwives.'* ***PDNS 38*** *'Obs involvement. Positively and supportively but with caution and close involvement of the obstetrician.'* ***PDNS 2*** *'I would look for as much information as possible e.g. on-line, journals, Parkinson's UK, other Parkinson's Nurses, on-line forum on the members area of Parkinson's Disease Nurse Specialist Association website, the patient's Parkinson's Consultant and Consultant Obstetrician, pharmacists.'* ***PDNS 3*** *'liaise with maternity team'* ***PDNS18*** *'Liaise with the obstetricians.'* ***PDNS 30***
Antenatal review	*'Emphasise their open access to the service.'* ***PDNS 10*** *'Increase visits'* ***PDNS 18*** *'Closer monitoring'* ***PDNS 23*** *'Frequent reviews'. 'Ask patient to keep symptoms diary'* ***PDNS 34***
C. Obstetrics suggested care	
Reasons for obstetric-led antenatal review	*'with medication involved'* ***O6*** *'would want to ensure no decline during pregnancy'* ***O7*** *'given the unknown challenges and the need for a multidisciplinary approach'* ***O4*** *'Multidisciplinary team including a medical midwife, obstetric physician and MFM obstetrician with advice from the patients primary neurologist'* ***O12*** *'extra reassurance, fetal growth scans, MDT input with close liaison between Obs, neuro and anaesthetics, consideration of VTE prophylaxis etc'* ***O10*** *'Could be either - if early in disease process and no concerns, MLC might be best. CLC would ensure liaison with neurology colleagues, contact with nurse specialist and joint planning for delivery and postnatal'* ***O14***

	'would be easier to arrange follow-ups and implement any management plan' ***O15***
Schedule of antenatal care	*'as standard regimen, more frequently if progressive Parkinson's disease activity'* ***O4*** *'standard obstetric care'* ***O6*** *'care as usual and more often based on complaints'* ***O5*** *'Pre-pregnancy counselling'* ***O12*** *'[appointments] Ideally coinciding with fetal growth scans.'* ***O10*** *'Regular monthly joint clinic'* ***O2***
Frequency of discussion with neurology team	*'Regular monthly joint clinic and contact if any concerns'* ***O2*** *'Once or twice if no problems, more frequently if progressive Parkinson's disease activity'* ***O4*** *'Once in the beginning of pregnancy and in the third trimester, also with anaesthetist'* ***O6*** *'At least each trimester.'* ***O10*** *'General planning discussion preferably pre-pregnancy, otherwise when booking with our clinic. Discussion with neurology after that only if needed or if altering medications'* ***O12*** *'Pre-conception .At booking . With change'* ***O13*** *'At booking, following any significant clinical change or change of medication, prior to delivery for planning'* ***O15***
Suggested delivery	*'Not [c-section] unless there were other obstetric indications'* ***O12*** *'No [c-section]. I would reserve section for Obstetric reasons only. There are pros and cons of this, but, as with many medical Obs patients, we would encourage an early epidural, offer induction of labour at term (to give some 'predictability') and have an honest dialogue with the pt and whole MDT about the birth plan.'* ***O10*** *'Not routinely - there can be allowances made to minimise active (pushing) phase'* ***O15***
Post-partum care	*'Depending of level of disability likely to need longer postnatal hospital stay and occupational therapy input around infant cares'* ***O12*** *'Monitor patient in HDU on the delivery suite for 24 hours postpartum. Be aware of potential for worsening on symptoms. Neurology review within 24 hours of delivery.'* ***O10*** *'ensure support from midwives'* ***O7*** *'Neurology follow up'* ***O14***
D. Midwifery suggested care	
Antenatal review	*'Obstetric referral, Obstetric led care'* ***M2*** *'During pregnancy I would expect the woman to be placed under consultant led care with multi-disciplinary input…The woman would also see her midwife in community to provide normal antenatal care, monitoring, and emotional support throughout the pregnancy.'* *'Physiotherapy input to reduce the risk of falls and therefore injury to the woman and fetus.' 'There may also be serial ultrasound scans to monitor fetal growth and development.'* ***M3*** *'I would mainly think about how well she is able to access antenatal care, possible home midwife visits maybe more appropriate than possible long waits in clinics.' 'Perhaps seeing a physio would help with balance issues (also antenatally).'* ***M1*** *'liaise with other health professional involved in current care. consultant led. foetal medicine early pregnancy. care physio referral. anaesthetic referral. Perni mental health team. assess if able to breast'* ***M14***

	'Booking and antenatal care: refer to consultant led care, refer for a specialist nurse who deals with Parkinson's , more antenatal appointment due to ?higher risk in pregnancy.' ***M15*** *'assess mobility. consider serial growth scans due to medication'* ***M16*** *'that the woman is seen by her medical, obstetric & anaesthetic team to ensure that a multi disciplinary care plan for her antenatal care & her delivery are made. the lady should be involved in all aspects of her care & the normal care pathway should be followed as much as possible.'* ***M19***
Intrapartum care	*'In labour, my train of thought is that she might tire easily if her Parkinson's is severe, so advising her periods of rest as well as helping her to be somewhat mobile during labour.'* ***M1*** *'During labour care and the woman might have regular mobility checks to reduce the risk of falls whilst also recommending active labour where possible.'* ***M3*** *'physical support in labour'* ***M5*** *'Labour care'* ***M10*** *'delivery in an Obstetric unit or Midwifery led unit alongside an Obstetric unit.'* ***M2*** *'The obstetricians would decide whether an early induction of labour 37-39 weeks gestation would be of benefit to ensure the best outcome.'* ***M3***
Post-partum care	*'Postnatal period I'd like so support her with how she handles her baby and how she can manage this with her movements.'* ***M1*** *'I also think it would be a good idea during pregnancy for the woman to have advise on caring for a newborn with her condition.'* ***M3*** *'assessment of adapted care for baby following delivery'* ***M5*** *'postnatal care afterwards'* ***M8***

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