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**Date:** 16 May2019

**Sources Searched:** Embase, Medline, DynaMed Plus

## **Medications to be Avoided in Myasthenia Gravis**

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[See full search strategy](#)

### **1. Management of Myasthenia Gravis in Pregnancy.**

**Author(s):** Waters, Janet

**Source:** Neurologic clinics; Feb 2019; vol. 37 (no. 1); p. 113-120

**Publication Date:** Feb 2019

**Publication Type(s):** Journal Article Review

**PubMedID:** 30470270

**Abstract:**Myasthenia gravis is an autoimmune disorder characterized by fluctuating weakness of extraocular and proximal limb muscles. It occurs in 1 in 5000 in the overall population and is 2 times more common in women than men. The onset in women is most common in the third decade, and risk of severe exacerbation occurs most frequently in the year after presentation. The disease does not have an impact on fertility and overlap with pregnancy is expected. This article provides a description of the disease process and its impact on the expecting mother, fetus, and newborn. Management options in pregnancy and lactation are discussed.

**Database:** Medline

### **2. Treatment Standards and Individualized Therapy of Myasthenia Gravis**

**Author(s):** Paul Urban P.; Jacobi C.; Jander S.

**Source:** Neurology International Open; 2018; vol. 2 (no. 2)

**Publication Date:** 2018

**Publication Type(s):** Review

Available at [Neurology International Open](#) - from Unpaywall

**Abstract:**A wide range of established treatment options is currently available for myasthenia gravis. These include cholinesterase inhibitors for symptomatic treatment and a broad spectrum of immunosuppressive, immunomodulating or cell-depleting options to modify the underlying immunological process. Appropriate use allows the great majority of patients to lead a normal life. Specialized centers integrating outpatient and in-hospital resources as well as interdisciplinary competences offer important advantages for optimum individualized therapy. Copyright © Georg Thieme Verlag KG Stuttgart New York.

**Database:** EMBASE



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### 3. Myasthenia Gravis - Exacerbation and Crisis

**Author(s):** Schroeter M.; Thayssen G.; Kaiser J.

**Source:** Neurology International Open; 2018; vol. 2 (no. 1)

**Publication Date:** 2018

**Publication Type(s):** Review

Available at [Neurology International Open](#) - from Unpaywall

**Abstract:** Myasthenic exacerbation and crisis are most critical incidences in myasthenia gravis. Even nowadays myasthenic crisis is a life-threatening condition, with a lethality of 2-3%. We review means of avoiding myasthenic exacerbation and crisis, elaborate on red flags and how to establish highly-active therapy in a timely manner. This includes the reasonable use of cholinesterase inhibitors, immunoadsorption or plasma exchange, as well as immunoglobulins and steroids. Immunosuppressive agents and monoclonal antibody therapy add to the therapeutic options. Intensive care of myasthenic patients includes the management of dysphagia and delirium. Importantly, the perioperative management of patients undergoing thymectomy and weaning are specific challenges in the treatment of myasthenic patients in the ICU. Establishing timely consequent immunosuppression and treatment of myasthenic patients in specialized outpatient centres help to avoid repetitive exacerbations and crises. Copyright © 2018 Georg Thieme Verlag KG Stuttgart . New York.

**Database:** EMBASE

### 4. An Update: Myasthenia Gravis and Pregnancy

**Author(s):** Hamel J.; Ciafaloni E.

**Source:** Neurologic Clinics; May 2018; vol. 36 (no. 2); p. 355-365

**Publication Date:** May 2018

**Publication Type(s):** Review

**Abstract:** Myasthenia gravis presents a risk factor for pregnancy and delivery, and can affect the newborn. In return, pregnancy can affect the course of myasthenia and worsen the disease during pregnancy requiring treatment modifications. Treatment optimization and drug safety should be addressed before conception. Delivery is complicated by prolonged labor. Newborns can develop neonatal myasthenia gravis, a treatable and transient disease. Patients should not be discouraged to become pregnant, but provided with supportive counseling, planning, and monitoring in a multidisciplinary team involving obstetrician, anesthesiologist, pediatrician, and neurologist. Pregnancy outcome is favorable in women who receive treatment and expert care. Copyright © 2018 Elsevier Inc.

**Database:** EMBASE

## 5. Severe Preeclampsia in the Setting of Myasthenia Gravis.

**Author(s):** Lake, Adam J; Al Khabbaz, Antoun; Keeney, Renée

**Source:** Case reports in obstetrics and gynecology; 2017; vol. 2017 ; p. 9204930

**Publication Date:** 2017

**Publication Type(s):** Case Reports

**PubMedID:** 28280642

Available at [Case reports in obstetrics and gynecology](#) - from Europe PubMed Central - Open Access

**Abstract:** Myasthenia gravis (MG) is a rare autoimmune disease that leads to progressive muscle weakness and is common during female reproductive years. The myasthenic mother and her newborn must be observed carefully, as complications during all stages of pregnancy and the puerperium may arise suddenly. Preeclampsia is a common obstetrical condition for which magnesium sulfate is used for seizure prophylaxis. However, magnesium sulfate is strongly contraindicated in MG as it impairs already slowed nerve-muscle connections. Similarly, many first-line antihypertensive medications, including calcium channels blockers and  $\beta$ -blockers, may lead to MG exacerbation. This case describes the effective obstetrical management of a patient with MG who developed severe preeclampsia. The effective use of levetiracetam and various antihypertensive medications including intravenous labetalol is described. A review of the ten reported cases of MG complicated by preeclampsia is examined to aggregate observations of clinical care, with focus on delivery methods, anticonvulsants, and antihypertensive medications.

**Database:** Medline

## 6. Myasthenia Gravis.

**Author(s):** Gilhus, Nils E

**Source:** The New England journal of medicine; Dec 2016; vol. 375 (no. 26); p. 2570-2581

**Publication Date:** Dec 2016

**Publication Type(s):** Journal Article Review

**PubMedID:** 28029925

Available at [The New England journal of medicine](#) - from Massachusetts Medical Society Please select "Login via Athens or your institution" and enter your OpenAthens username and password.

Available at [The New England journal of medicine](#) - from ProQuest (Health Research Premium) - NHS Version

**Database:** Medline

## **7. Neurologic disease with pregnancy and considerations for the obstetric anesthesiologist**

**Author(s):** Hopkins A.N.; Akst S.A.; Berger J.S.; Alshaeri T.

**Source:** Seminars in Perinatology; Oct 2014; vol. 38 (no. 6); p. 359-369

**Publication Date:** Oct 2014

**Publication Type(s):** Review

**PubMedID:** 25176638

**Abstract:** Women with neurologic conditions present a challenge during pregnancy and in the peripartum period. Given the low prevalence of these diseases during pregnancy, most management decisions are guided by retrospective reviews and case reports. This article reviews current literature for some of the more common or complex neurologic conditions affecting pregnancy with special consideration for anesthetic management. In particular, epilepsy; multiple sclerosis; primary intracranial hypertension; secondary intracranial hypertension-Arnold-Chiari malformations and intracranial neoplasms; spinal cord injury; neuromuscular junction disorders-myasthenia gravis; and hereditary neuromuscular disorders-myotonic dystrophy and spinal muscular atrophy will be discussed. By increasing understanding of anesthetic issues for parturients with neurologic disease, providers may more effectively anticipate anesthetic considerations, thereby optimizing care plans. Copyright © 2014 Elsevier Inc.

**Database:** EMBASE

## **8. Myasthenia in pregnancy: Best practice guidelines from a UK multispecialty working group**

**Author(s):** Norwood F.; Dhanjal M.; Hill M.; James N.; Jungbluth H.; Kyle P.; O'Sullivan G.; Palace J.; Hilton-Jones D.; Robb S.; Williamson C.; Nelson-Piercy C.

**Source:** Journal of Neurology, Neurosurgery and Psychiatry; May 2014; vol. 85 (no. 5); p. 538-543

**Publication Date:** May 2014

**Publication Type(s):** Article

**PubMedID:** 23757420

Available at [Journal of Neurology, Neurosurgery and Psychiatry](#) - from BMJ Journals - NHS

Available at [Journal of Neurology, Neurosurgery and Psychiatry](#) - from ProQuest (Health Research Premium) - NHS Version

**Abstract:** A national UK workshop to discuss practical clinical management issues related to pregnancy in women with myasthenia gravis was held in May 2011. The purpose was to develop recommendations to guide general neurologists and obstetricians and facilitate best practice before, during and after pregnancy. The main conclusions were (1) planning should be instituted well in advance of any potential pregnancy to allow time for myasthenic status and drug optimisation; (2) multidisciplinary liaison through the involvement of relevant specialists should occur throughout pregnancy, during delivery and in the neonatal period; (3) provided that their myasthenia is under good control before pregnancy, the majority of women can be reassured that it will remain stable throughout pregnancy and the postpartum months; (4) spontaneous vaginal delivery should be the aim and actively encouraged; (5) those with severe myasthenic weakness need careful, multidisciplinary management with prompt access to specialist advice and facilities; (6) newborn

babies born to myasthenic mothers are at risk of transient myasthenic weakness, even if the mother's myasthenia is wellcontrolled, and should have rapid access to neonatal high-dependency support.

**Database:** EMBASE

## 9. Pregnancy and myasthenia gravis.

**Author(s):** Massey, Janice M; De Jesus-Acosta, Carolina

**Source:** Continuum (Minneapolis, Minn.); Feb 2014; vol. 20 (no. 1)

**Publication Date:** Feb 2014

**Publication Type(s):** Case Reports Journal Article Review

**PubMedID:** 24492814

Available at [Continuum \(Minneapolis, Minn.\)](#) - from Europe PubMed Central - Open Access

**Abstract:****PURPOSE OF REVIEW**Myasthenia gravis (MG) is an acquired autoimmune disorder characterized by fluctuating ocular, limb, or oropharyngeal muscle weakness due to an antibody-mediated attack at the neuromuscular junction. The female incidence of MG peaks in the third decade during the childbearing years. A number of exacerbating factors may worsen MG, including pregnancy. When treatment is needed, it must be carefully chosen with consideration of possible effects on the mother with MG, the pregnancy, and the fetus.**RECENT FINDINGS**Decisions are complex in the treatment of women with MG contemplating pregnancy or with presentation during pregnancy. While data is largely observational, a number of characteristic patterns and issues related to risk to the patient, integrity of the pregnancy, and risks to the fetus are recognized. Familiarity with these special considerations when contemplating pregnancy is essential to avoid potential hazards in both the patient and the fetus. Use of immunosuppressive agents incurs risk to the fetus. Deteriorating MG with respiratory insufficiency poses risk to both the mother and the fetus.**SUMMARY**This article reviews available information regarding expectations and management for patients with MG in the childbearing age. Treatment decisions must be individualized based on MG severity, distribution of weakness, coexisting diseases, and welfare of the fetus. Patient participation in these decisions is essential for successful management.

**Database:** Medline

## 10. Myasthenia gravis and pregnancy.

**Author(s):** Varner, Michael

**Source:** Clinical obstetrics and gynecology; Jun 2013; vol. 56 (no. 2); p. 372-381

**Publication Date:** Jun 2013

**Publication Type(s):** Journal Article Review

**PubMedID:** 23563874

Available at [Clinical obstetrics and gynecology](#) - from Ovid (LWW Total Access Collection 2015 - Q1 with Neurology)

**Abstract:**Myasthenia gravis is an autoimmune disease of the neuromuscular junction characterized by painless fluctuating skeletal muscle weakness. Disease exacerbations are more likely to occur in

the first trimester or puerperium. A number of medications commonly used in obstetric practice can exacerbate the disease. The effect of pregnancy on myasthenia varies substantially from woman to woman and also from pregnancy to pregnancy in the same woman. Mainstay treatments involve acetylcholine esterase inhibitors, corticosteroids and other immunosuppressants, and adequate rest. Newborns may suffer in utero or neonatal consequences, usually transient, of transplacental antibody exposure.

**Database:** Medline

### **11. Myasthenia gravis and pregnancy: anaesthetic management--a series of cases.**

**Author(s):** Almeida, Carlos; Coutinho, Ester; Moreira, Daniela; Santos, Ernestina; Aguiar, José

**Source:** European journal of anaesthesiology; Nov 2010; vol. 27 (no. 11); p. 985-990

**Publication Date:** Nov 2010

**Publication Type(s):** Journal Article

**PubMedID:** 20733499

Available at [European journal of anaesthesiology](#) - from Ovid (Journals @ Ovid) - London Health Libraries

**Abstract:**BACKGROUND AND OBJECTIVE Myasthenia gravis is an autoimmune neuromuscular disease, usually affecting women in the second and third decades. The course is unpredictable during pregnancy and puerperium. Myasthenia gravis can cause major interference in labour and partum and exacerbations of the disease frequently occur. The aim of this series of cases is to analyse retrospectively the anaesthetic management of myasthenia gravis patients and complications during the peripartum period. MATERIALS AND METHODS Retrospective, single centre study from clinical files of female myasthenia gravis patients who delivered between 1985 and 2007 at Hospital de Santo António, Porto, Portugal. RESULTS Seventeen myasthenia gravis patients delivered between 1985 and 2007 in Hospital Santo António. Two women were not included in the study as they had a spontaneous abortion in the first trimester. Four patients presented exacerbations of the disease during pregnancy, no exacerbation occurred in eight patients and three patients presented their first symptoms of myasthenia gravis during pregnancy (without diagnosis at time of delivery). Concerning the eight patients without exacerbations of the disease during pregnancy, pregnancy was brought to term in 87.5% of the cases; five women were submitted to nonurgent caesarean section (62.5%); and epidural block was performed in six patients (75%). No complications related to anaesthesia occurred in the peripartum period. Concerning the four patients with exacerbations of the disease, pregnancy was brought to term in three cases (75%); three women were submitted to nonurgent caesarean section (75%); and epidural block was performed in three patients (75%). One patient underwent an uncomplicated thymectomy under general anaesthesia during pregnancy and, in the postpartum period, there was a myasthenic crisis in another patient. Concerning the three patients without a myasthenia gravis diagnosis at partum, one woman already being followed for presenting muscular weakness had a vaginal delivery under epidural block, without complications; another patient, presenting discrete supine dyspnoea, was submitted to elective caesarean section under spinal block and developed severe dyspnoea that required mechanical ventilation and ICU admission; and in the remaining case, a woman presenting mild blurred vision was submitted to general anaesthesia, which resulted in delayed emergence, muscular weakness and respiratory failure. Pregnancy went full term in all cases (100%). No newborn had a myasthenic crisis. CONCLUSION Myasthenia gravis can interfere slightly with



pregnancy and partum, although exacerbations of the disease occur frequently. Strict surveillance and therapeutic optimisation are crucial. In women with controlled disease, caesarean section should be carried out only if there are obstetric reasons. Locoregional anaesthesia is preferred, mainly epidural block. A good multidisciplinary cooperation, specific precautions and surveillance can certainly contribute to an improved outcome in myasthenia gravis patients during the peripartum period.

**Database:** Medline

## **12. Myasthenia gravis during pregnancy**

**Author(s):** Ferrero S.; Esposito F.; Biamonti M.; Bentivoglio G.; Ragni N.

**Source:** Expert Review of Neurotherapeutics; Jun 2008; vol. 8 (no. 6); p. 979-988

**Publication Date:** Jun 2008

**Publication Type(s):** Review

**PubMedID:** 18505362

Available at [Expert Review of Neurotherapeutics](#) - from ProQuest (Health Research Premium) - NHS Version

**Abstract:**Myasthenia gravis (MG) affects women in the second and third decades of life, overlapping with the childbearing years. During pregnancy, the course of this disease is unpredictable; worsening of symptoms occurs more likely during the first half of pregnancy and postpartum. MG can be well managed during pregnancy with relatively safe and effective therapies. Cesarean section is recommended only for obstetric reasons; epidural anesthesia is advised to reduce physical and emotional stress. Anticholinesterase drugs are the mainstay of treatment, when MG symptoms are not satisfactorily controlled, corticosteroids, azathioprine and in some cases cyclosporin A may be used. Life-threatening conditions (e.g., respiratory insufficiency) may occur during pregnancy; therefore, intensive check-ups by a gynecologist and a neurologist are necessary. © 2008 Expert Reviews Ltd.

**Database:** EMBASE

## **13. Anaesthetic considerations for patients with a pre-existing neurological deficit: Are neuraxial techniques safe?**

**Author(s):** Vercauteren M.; Heytens L.

**Source:** Acta Anaesthesiologica Scandinavica; Aug 2007; vol. 51 (no. 7); p. 831-838

**Publication Date:** Aug 2007

**Publication Type(s):** Review

**PubMedID:** 17488315

Available at [Acta Anaesthesiologica Scandinavica](#) - from Wiley Online Library Science , Technology and Medicine Collection 2017

**Abstract:**Pre-existing neurological and muscular disease may be a specific concern for anaesthetists as they need to consider the effect of anaesthesia upon the disease, vice versa, and the interaction of anaesthesia with the medication taken by the patient. Despite a lack of controlled studies, many anaesthetists, being afraid of a claim, will prefer general rather than regional anaesthesia in these



patients. Nevertheless regional anaesthesia certainly merits its place because it offers undeniable advantages. A good pre-operative examination is very important while patients should also be informed about peri-operative implications of anaesthesia, surgery and stress. Paraesthesias, epinephrine and high concentrations of local anaesthetics should be avoided in the majority of the diseases. Some diseases may benefit from epidural anaesthesia while for others a spinal technique may be the technique of preference. Special attention should be paid to patients with spinal stenosis despite recent reassuring reports with respect to safety of regional anaesthetic techniques. Anaesthetists should not automatically take all responsibility in case of progressive or new deficit after the procedure. © 2007 The Authors.

**Database:** EMBASE

#### **14. Myasthenia gravis in pregnancy and birth: identifying risk factors, optimising care.**

**Author(s):** Hoff, J M; Daltveit, A K; Gilhus, N E

**Source:** European journal of neurology; Jan 2007; vol. 14 (no. 1); p. 38-43

**Publication Date:** Jan 2007

**Publication Type(s):** Research Support, Non-u.s. Gov't Comparative Study Journal Article

**PubMedID:** 17222111

Available at [European journal of neurology](#) - from Wiley Online Library Science , Technology and Medicine Collection 2017

**Abstract:** Women with myasthenia gravis (MG) have increased risk of pregnancy complications and an adverse pregnancy outcome. This study examined risk factors for such complications in order to improve the care for pregnant MG women. Through the Medical Birth Registry of Norway, 73 MG mothers with 135 births were identified. Their obstetrical and clinical records were examined. Data on pregnancy, delivery and the newborn were combined with information on mother's disease. The risk for neonatal MG was halved if the mother was thymectomized ( $P = 0.03$ ). Children with neonatal MG were more likely to display signs of foetal distress during delivery ( $P = 0.05$ ). Only in one-third of the pregnancies did the patient see a neurologist during pregnancy. These patients used MG medication more often during pregnancy ( $P = 0.001$ ), and were more likely to be thymectomized ( $P = 0.007$ ). They also had a higher rate of elective sections ( $P = 0.009$ ). Thymectomy may have a protective effect against neonatal MG. Neonatal MG can cause foetal distress during delivery. Most MG women benefit from being examined by a neurologist during pregnancy, to minimize risks and select the best delivery mode in collaboration with obstetricians.

**Database:** Medline

#### **15. Labor analgesia for the parturient with neurological disease: What does an obstetrician need to know?**

**Author(s):** Kuczkowski K.M.

**Source:** Archives of Gynecology and Obstetrics; Apr 2006; vol. 274 (no. 1); p. 41-46

**Publication Date:** Apr 2006

**Publication Type(s):** Review

**PubMedID:** 16463165



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Available at [Archives of Gynecology and Obstetrics](#) - from SpringerLink

**Abstract:** Several neurological disorders including multiple sclerosis, myasthenia gravis, epilepsy, spinal cord injury, and subarachnoid hemorrhage are encountered with increasing frequency in pregnant women worldwide. Although there is absence of uniform anesthetic guidelines for pregnant patients with most of these (and other) neurological disorders, and the decision whether or not to administer regional anesthesia is based on an individual risk-to-benefit ratio on a case-by-case basis, few of these disorders contraindicate the use of neuraxial anesthesia. This article attempts to review the specific concerns for administration of labor analgesia posed by multiple sclerosis, myasthenia gravis, epilepsy, paraplegia and subarachnoid hemorrhage. © Springer-Verlag 2006.

**Database:** EMBASE

## 16. Myasthenia gravis: Management issues during pregnancy

**Author(s):** Ferrero S.; Nicoletti A.; Petrera P.; Ragni N.; Pretta S.

**Source:** European Journal of Obstetrics and Gynecology and Reproductive Biology; Aug 2005; vol. 121 (no. 2); p. 129-138

**Publication Date:** Aug 2005

**Publication Type(s):** Review

**PubMedID:** 16054951

**Abstract:** Myasthenia gravis (MG) often affects women in the second and third decades of life, overlapping with the childbearing years. The course of the disease is unpredictable during pregnancy; however, worsening of symptoms occurs more likely during the first trimester and postpartum. MG can be well managed during pregnancy with relatively safe and effective therapies. Anticholinesterase drugs are the mainstay of treatment, when MG symptoms are not satisfactorily controlled, corticosteroids, azathioprine and in some cases cyclosporin A can be used. Until information is available regarding safety, mycophenolate mofetil should be discontinued before pregnancy. Pregnancy should be avoided in women treated with methotrexate because of the risk of causing typical malformations. Plasmapheresis and intravenous immunoglobulins have been successfully used in the treatment of MG crisis during pregnancy. Caesarean section is recommended only for obstetric reasons; forceps delivery and vacuum extraction are sometimes required. Epidural anesthesia is advised to reduce physical and emotional stress. MG during pregnancy can lead to serious life-threatening conditions, including respiratory insufficiency; therefore, intensive checkups by a gynaecologist and a neurologist are necessary. Women with myasthenia gravis should not be discouraged from conceiving; however, they should discuss their plan for pregnancy with their neurologist and their gynaecologist. © 2005 Elsevier Ireland Ltd. All rights reserved.

**Database:** EMBASE



## Strategy 654722

#	Database	Search term	Results
1	EMBASE	exp "MYASTHENIA GRAVIS"/	20313
2	EMBASE	("Myasthenia gravis").ti	10766
3	EMBASE	(1 OR 2)	20449
4	EMBASE	exp "DRUG CONTRAINDICATION"/	29534
5	EMBASE	(contraindicat*).ti,ab	65246
6	EMBASE	(4 OR 5)	89671
7	EMBASE	(3 AND 6)	226
8	EMBASE	*"ADVERSE DRUG REACTION"/ OR *"DRUG HYPERSENSITIVITY"/	129806
9	EMBASE	(3 AND 8)	200
10	EMBASE	*"DISEASE EXACERBATION"/ OR *"DISEASE FLARE"/	9835
11	EMBASE	(3 AND 10)	57
12	Medline	exp "MYASTHENIA GRAVIS"/	14393
13	Medline	("Myasthenia gravis").ti	9949
14	Medline	(12 OR 13)	15186
15	Medline	exp "CONTRAINDICATIONS, DRUG"/	170
16	Medline	(contraindicat*).ti,ab	42339




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17	Medline	(15 OR 16)	42452
18	Medline	(14 AND 17)	52
19	Medline	exp "DRUG-RELATED SIDE EFFECTS AND ADVERSE REACTIONS"/ OR exp "DRUG INTERACTIONS"/	419289
21	Medline	exp "DISEASE PROGRESSION"/	166932
22	Medline	(14 AND 19)	166
23	EMBASE	exp "DRUG TOXICITY"/	115405
24	EMBASE	(3 AND 23)	32
25	Medline	exp "DRUG HYPERSENSITIVITY"/	44313
26	Medline	(14 AND 25)	39
27	Medline	(exacerbat*).ti,ab	95623
28	Medline	(14 AND 27)	350
29	EMBASE	exp PREGNANCY/	630630
30	EMBASE	(3 AND 29)	446
31	EMBASE	exp "ADVERSE DRUG REACTION"/	495404
32	EMBASE	(30 AND 31)	51
33	EMBASE	exp "OBSTETRIC ANESTHESIA"/	11665
34	EMBASE	(3 AND 33)	21



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35	Medline	exp PREGNANCY/	861916
36	Medline	(pregnan*).ti,ab	463754
37	Medline	(35 OR 36)	961461
38	Medline	(14 AND 37)	503
39	Medline	(19 AND 38)	4
40	Medline	exp "ANESTHESIA, OBSTETRICAL"/	12771
41	Medline	exp "ANALGESIA, OBSTETRICAL"/	3822
42	Medline	(40 OR 41)	16099
43	Medline	(38 AND 42)	17