In Belgium, the Maternal Intensive Care (MIC) concept was introduced by law in 1996. The Royal Decree (RD) of Augustus 20th 1996 defines Maternal Intensive Care as follows:

“The MIC-service is recognized as a division of the maternity department. This division is dedicated to the intensive observation of high-risk pregnancies. The division also admits in its P* function, patients with a pregnancy at high risk for neonatal observation at a Neonatal Intensive Care (NIC) service and patients who will need highly specialized postpartum care.” The P* function is mandatory constituted by a MIC-service and a NIC (Neonatal Intensive Care) service; the MIC-service will serve as a referral centre for a group of hospitals totaling a minimum of 5000 deliveries per year”.

However, the Royal Decree has not precisely defined the statute, the purposes, nor the function and terms of reference of a MIC-service. What is intensive observation? What are the indications for which a baby potentially needs neonatal intensive care? How are high-risk pregnancies defined? When does a patient need highly specialised post partum care?

Hence, the indications during pregnancy, delivery, or post-partum leading to an admission in a MIC-service are not specified. This legal frame with
regard to maternal intensive care seems not sufficient to guide the daily obstetrical practice.

In this article, we conducted a systematic literature review in an effort to resolve the vagueness related to the definition and admission criteria for optimal maternal intensive care, based on the current scientific knowledge and evidence.

Sources and study selection

This systematic literature review was based on an extensive search in the electronic databases OVID MEDLINE, EMBASE, COCHRANE and CINHAL. The CEBAM database was accessed to review the relevant (clinical) guidelines on the topic.

The limits were set on English, Dutch or French publications from January 1997 to December 2007. The searches were systematically updated during the writing process, the last update took place July 15th, 2009. Following keywords and combinations of these keywords were used: maternal/obstetric intensive care, subacute care, intermediate care, postacute care, critical care, sub intensive care, progressive patient care, postnatal care, perinatal care, obstetrical nursing, neonatology, pregnancy, maternal mortality/morbidity and pregnancy complication.

We started our literature search in OVID MEDLINE and applied the same search strategy in EMBASE, COCHRANE and CINHAL. The different steps followed were: enter MeSH terms/keywords in selected databases, title and abstract evaluation (selection criteria below), full text evaluation, critical appraisal and selection of articles. The detailed flow chart from the search strategy used for the different databases is presented in Figure 1. Several articles were found through the snowball method (hand search). During full text evaluation, one article of high relevance written by Zeeman (2006), was retrieved by hand search. This systematic literature review evaluated 30 articles about obstetric intermediate and intensive care, hence we retrieved and evaluated all studies selected by Zeeman. The studies of fairly good quality were included in our selection.

The selection criteria used for the title and abstract evaluation were:

— No comments and case reports;
— No specific ‘neonatologic’ research: articles describing research on science in medically caring for the newborn were excluded (for example research about growth retardation and very low birth weight);
— No ‘infertility’ research: articles on specific research on infertility were excluded (for example ovarian hyperstimulation syndrome).

The critical appraisal of the selected articles (after full text evaluation) was based on “The checklist for observational studies” from the Agency for Healthcare Research and Quality (West et al., 2002). Two individual researchers (ASVP and HV) performed separately the assessment of the selected studies and attributed a level of evidence based on the above mentioned checklist. Evidence level 3 is non-experimental descriptive research with a good design: comparative research, correlation studies, case-series. Level 4 are reports of expert groups, expert opinions, clinical experience of respected authorities. A detailed overview of the selected articles (evidence table) is available in the annexes.

As stated above, relevant guidelines on definitions and admission criteria were also retrieved through CEBAM (this is the Belgian branch of the Cochrane collaboration and has a portal site that gathers up to date evidence based search engines). The following search engines were systematically explored in the Dutch-language databases: CBO, Nederlands Huisartsengenootschap, Richtlijnen Kenniscentrum (KCE), NVOG, RIZIV richtlijnen and WVVH Domus Medica. Furthermore, Anglo-Saxon guidelines search engines (Guideline Finder UK, National Guideline Clearinghouse, New Zealand Guidelines Group, RCOG, ACOG, Tripdatabase, Sumsearch, Prodigy Guidelines and WHO) were searched with keywords: maternal/obstetric intensive care, subacute care, intermediate care, postacute care, critical care, sub intensive care, progressive patient care, postnatal care, perinatal care, obstetrical nursing, neonatology, pregnancy, maternal mortality/morbidity and pregnancy complication. We identified 4 potential relevant guidelines and explored everything related to high-risk, complication and problem. Similar selection criteria as in the above literature search were used and critical appraisal was done by means of the Appraisal of Guidelines Research and Evaluation instrument (The AGREE collaboration, 2001).

Results

The search in OVID MEDLINE, EMBASE, COCHRANE and CINHAL retrieved 180 potentially relevant articles. Based on title and abstract evaluation, 136 articles were excluded, 44 articles were eligible for more detailed evaluation. After full text evaluation another 30 were excluded and 14 studies were submitted to critical appraisal. The quality of all 14 studies were evaluated as fairly good and therefore included in the systematic review (Table I, Fig. 1).
The search for guidelines resulted in two types of guidelines, general (low risk) maternity care guidelines and guidelines on a specific topic of complicated peripartal care e.g. diabetes and pregnancy, cardio-vascular problems during pregnancy, etc. Only one guideline (Duodecim, 2006) was selected because it specified management/treatment of pregnant women with heart and vascular diseases (hypertension, heart disease), thrombotic complications, metabolic disorders (diabetes, hypothyroidism, hyperthyroidism, obesity), neurological diseases (epilepsy, migraine, disturbances of cerebral circulation), renal diseases, rheumatic disorders, psychiatric problems, bronchial asthma and cancer. Unfortunately no recommendations were made about the appropriate level of care for each type of pathology.

We found no specific guidelines concerning overall maternal/obstetrical intensive/intermediate care, we did find some general guidelines concerning admission and discharge from general intensive care and high dependency/intermediate care units (Nasraway et al., 1998). Within these general admission and discharge criteria nothing was specifically mentioned for pregnancy and childbirth. The search for guidelines resulted in the selection of only one guideline.

Table I. — Overview selected studies maternal intensive care

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Study</th>
<th>Country</th>
<th>Population</th>
<th>Study type</th>
<th>EL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Zeeman G (2006)</td>
<td>The Netherlands</td>
<td>/</td>
<td>(syst.) literature review</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Fowler SJ (2005)</td>
<td>New Zealand (Wellington)</td>
<td>240 hospitals</td>
<td>International retrospective health care survey of operative obstetric services</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Biswas AB et al. (2005)</td>
<td>India (West Bengal)</td>
<td>408 health facilities</td>
<td>Cross sectional health facility survey of minimum levels of Emergency ObstC</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Okafor U and Aniebue U (2004)</td>
<td>Nigeria</td>
<td>18 patients admitted to an obstetric ICU</td>
<td>Retrospective tertiary centre based analysis of obstetrical ICU admissions (health care survey)</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Zeeman G et al. (2003)</td>
<td>USA</td>
<td>483 critically ill peripartum women</td>
<td>Prospective evaluation and analysis of OICU and M/S ICU obstetrical admissions (health care survey)</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Schatz et al. (2003)</td>
<td>USA</td>
<td>1739 pregnant asthmatic patients, &lt; 26 weeks gestation</td>
<td>Prospective observational cohort study</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Heinonen S et al. (2002)</td>
<td>Finland</td>
<td>22 consecutive obstetric patients admitted to a mixed medical/surgical ICU</td>
<td>Retrospective tertiary based review of all obstetric patients treated on the ICU at Kuopio University Hospital</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Afessa B et al. (2001)</td>
<td>USA</td>
<td>74 obstetric patients admitted to the ICU</td>
<td>Tertiary centre based retrospective analysis of obstetric ICU admissions (health care survey)</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Ryan M et al. (2000)</td>
<td>Ireland</td>
<td>123 patients admitted on the HDU of an regional obstetric centre (free standing maternity unit)</td>
<td>Regional obstetric hospital based retrospective analysis of all hospital case notes and HDU/ICU registers from HDU admissions and medical charts from the referral ICU (health care survey)</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Baskett T and Sternadel, J (1998)</td>
<td>Canada</td>
<td>55 patients that required transfer for critical care and 2 maternal deaths</td>
<td>Retrospective tertiary centred analysis of all maternal deaths and referrals to critical care.</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>Cordingley J and Rubin A (1997)</td>
<td>UK</td>
<td>232 consultant obstetric units</td>
<td>Retrospective nationwide health care survey of all UK units providing obstetric recovery facilities, high dependency and intensive care</td>
<td>3</td>
</tr>
</tbody>
</table>

1 EL: Evidence Level
An important finding of this systematic literature review is that there is hardly any literature on maternal intensive care. This thorough literature search did not reveal any publication that contributes to a sizeable extent on how qualitative maternal intensive care should be defined and what the admission criteria for a MIC-service should be. Most articles on the subject are literature reviews, no Cochrane reviews and only very few systematic reviews, no randomized controlled trials and controlled clinical trials were found. The majority of the selected articles were retrospective observational tertiary centre based studies, with levels of evidence between 3 and 4. These studies explored the individual tertiary settings and findings can not be generalized because of the limited number of patients and the randomly selected criteria for admission.

The results of our literature review are described below in three separate sections: terminology, definition of maternal intensive care and admission criteria for a MIC-service.

**Terminology**

**Graded Care**

Health care organisations around the globe need to cope with a rising demand for care, (evidence based)
scientific evolutions, increasing costs and limited budgets, limited beds, insufficient medical and para-
medical personnel, etc. These restrictions stimulate
health care managers and policy makers to reorganise
healthcare services more efficiently. An example of a reasonably new health care structure is the
‘graded care’ structure (Popovich, 1991; Vincent and
Buchardi, 1999). The levelled/graded care structure
contains three levels of care. Beside the established
general ward and Intensive Care Unit (ICU), the
intermediate care level was introduced in the nineties. These intermediate care units (also termed
high-dependency or step-up/step-down units) have
generally a higher nurse/patient ratio and more
facilities for intensive monitoring than a general
ward, but fewer staff and less invasive equipment
than on an ICU. This intermediate care facility is
required for patients who have a condition that warrants more intensive care or monitoring than can be
provided on a general ward, to step up to care inter-
mediate between that on a general ward and the ICU,
and for others appropriate to step down from ICU to
general ward. Such areas cater for patients who do
not require full ICU care but are thought to need
more care than can be offered on the general ward.

Maternal Intensive care

An important result of this literature review is that
the concept ‘maternal intensive care’ was not found
elsewhere. Every country has its own system
of healthcare and adapted terminology to refer to
what we understand as maternal intensive care.
Moreover, these country-specific terminology and
congcepts are scarcely defined and explained in
the retrieved studies. This is probably due to the
obviousness of these different health care contexts
to the authors.

We did find concepts referring in a certain sense
to what ranges under maternal intensive care (MIC)
namely: high-dependency care, maternity high-
dependency care, obstetrical intensive care, obstetrical
intermediate care, emergency obstetric care, and
obstetric critical care. Terms that refer to the MIC-
service are: intensive care unit, intensive therapy
unit, maternity/maternal high dependency unit, high
dependency unit, post anaesthesia care unit, critical
care obstetric unit, maternity recovery ward, obstet-
rical intensive care unit, high-risk antepartum unit,
maternal-foetal ICU, consultant obstetric unit, recov-
ery area for obstetric patients, (specialised) obstetric
ICU’s, obstetric hospital (Biswa et al., 2005; Geller
et al., 2002; Lee, 2004; Okafor and Aniebue, 2004;
Ryan et al., 2000; Sisson et al., 2004; Zeeman,
2006). Furthermore, the concepts referring to certain
aspects of maternal intermediate and intensive care
are used interchangeably, depending on the country-
specific health care organisation. For example in
some countries mechanical ventilation is a part of
obstetrical high dependency care and in others it is
only located within the intensive care unit.

This confusion of meanings and terminology is
also found within the Belgian concept ‘maternal inten-
sive care’. Following a widespread definition of
intensive care, patients require intensive care when
they need mechanical ventilation and/or multiple
organ support and/or invasive monitoring and/or
artificial life support (Mirghani et al., 2004). This
level of care is not provided in the MIC-services, but
in the ICU-services. In other words the term ‘matern-
al intensive care’ is a rather confusing since it
seems to refer to a level of intensive care but is in
reality a level of intermediate care. The MIC-service
is in this respect best described as a tertiary care
function acting on intermediate care level in analogy
to the graded care concepts in critical care medicine.

Definition maternal intensive care

The results of this systematic literature review on
maternal intensive care provided a very diverse, but
limited amount of scientific literature. The last
15 years several reports from centres all over the
world described the characteristics and treatment of
critically ill pregnant or puerperal women. Studies
report significant variations in patient populations,
definitions of major morbidity, ICU admission
criteria, utilisation rates, treatment and outcomes,
hospital settings, nursing policies, and management
protocols (Zeeman, 2006). Most of the published
international literature about pregnancy complica-
tions and (severe) maternal morbidity deals with
intensive care for peripartal women. Research on
for example hypertensive problems and pregnancy,
cardiac disease and pregnancy, haemorrhage, etc. are
omnipresent. All of these articles addressed certain
aspects of (possible) life-threatening situations in
relation to maternal-foetal morbidity. Specific
studies on intermediate levels of obstetric care are
scarce. Systems of care applicable to the general
(non-obstetrical) critical care have been extrapolated
to pregnant patients (Gopalan and Muckart, 2004;
Martin and Foley, 2006). Models or detailed guide-
lines from any specialty organisation describing the
plan of care of critically ill obstetric patients do not
exist (Zeeman, 2006).

We identified 180 eligible articles of which 14 rel-
evant MIC-articles of relatively good quality were
selected. Almost every study focused on a tertiary
centre based retrospective analysis of hospital
records of parturients admitted to the (obstetrical)
ICU or, in a few articles, to the high dependency
unit. These studies explored the individual tertiary settings and findings can not be generalized because of the limited number of patients and the randomly selected criteria for admission. Nearly all evidence regarding maternal intensive care was indirect evidence through ICU literature. Few articles studied investigated the functioning of MIC-services and the organisational aspects of the associated hospital ward in depth (Biswas et al., 2005; Hazelgrove et al., 2001; Ryan et al., 2000).

Admission criteria for maternal intensive care

Similar to the lack of a consensus definition for maternal intensive care, an evidence-based model of admission criteria for a MIC-service doesn’t exist (Zeeman, 2006). In the underneath listing we present a summary of the most important admission criteria internationally widely used (Afessa et al., 2001; Baskett and Sterndel, 1998; Bewley and Creighton, 1997; Biswas et al., 2005; Farkas and Watson, 1996; Fowler, 2005; Hazelgrove et al., 2001; Heinonen et al., 2002; Keizer et al., 2006; Lee, 2004; Mirghani et al., 2004; Neto, 2006; Okafor and Aniebue, 2004; Panchal and Harris, 2000; Ryan et al., 2000; Schatz, 2003; Wheatley et al., 1997; Zeeman et al., 2003; Zeeman, 2006).

(Pre)eclampsia and haemorrhage are the two commonest mentioned reasons for admission within the reviewed literature. The underneath list of complications is a brief synthesis and is not exhaustive.

**Direct obstetrical complications:** Pre-eclampsia, HELLP, severe haemorrhage, trombo-embolic disorders, sepsis, placental abruption/prævia, inevitable premature labour (before 32 weeks), premature rupture of the membranes (before 32 weeks), intra uterine growth retardation (on vascular basis), congenital malformation wherefore early treatment is recommended and multiple pregnancy (more than 2 neonates or threatening premature birth before 34 weeks).

**Indirect obstetrical complications:** Cardiac and vascular disease (e.g. hypertension, thyrotoxicosis, plasmapheresis, anaemia, ...), pulmonary disease (e.g. asthma or pneumonia, ...), neurological disease, gastro-intestinal disease (e.g. diabetes mellitus, cholecystitis, pancreatitis, appendicitis, peritonitis, ...), endocrine disease (e.g. thyrotoxicosis, ...), infectious and parasitical disease, drug dependence, intoxication, trauma, and psychiatric disease.

The available literature and guidelines did not provide clear evidence-based criteria to tackle the question which level of maternal morbidity should ideally be treated at which level of care.

Discussion / Conclusion

An important result from our systematic literature review was that we were not able to find any literature which mentioned or referred to the concept “maternal intensive care”. Concepts as “high-dependency care” and “obstetrical intermediate care” appeared to be best comparable to the typical Belgian MIC-service. MIC-services provide a level of care in between standard and intensive care. Therefore we propose to use the less confusing concept ‘Maternal Intermediate Care (MIC)’ to refer to what is now understood as ‘Maternal Intensive Care’.

The results of this systematic literature review on maternal intensive care provided a very diverse, but very limited amount of scientific literature. A reasonable amount of articles/studies was found about specific aspects of intensive or critical obstetric care. Few articles studied, investigated the functioning of maternal intensive care and the organisational aspects of the associated hospital ward in depth.

Similar to the lack of evidence on the maternal intensive care definition, little information was found on the admission criteria for maternal intensive care. Pre-eclampsia and haemorrhage were the two most common disorders wherefore admission at a maternal intensive care unit was deemed necessary. We did not find any article or guideline that could contribute to a sizeable extent to tackle the question which level of maternal/fetal pathology should be treated at which level of care. Most guidelines focused on normal pregnancy care or on the appropriate care for a specific pregnancy or not-pregnancy related disease.

This systematic literature review revealed a great lack of literature and evidence about definitions and admission criteria for maternal intensive care. Further research is needed to create an evidence-based basis for an efficient utilization of maternal intensive care services. A clear triage-system for maternal morbidity could help clinicians to attribute women to the appropriate level of care. Reorganising the Belgian health care system into 3 distinct levels of care (standard care, intermediate care and intensive care) with clear-cut guidelines and referral pathways could benefit the quality of maternity services.

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References


