

Assessing Uterine Rupture: A Bibliometric Analysis of a Critical Emergency for Women's Health

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Abstract

Objective: This study aimed to provide a comprehensive bibliometric analysis of academic literature related to uterine rupture, highlighting trends, publication productivity, and key contributors in this critical area of women's health.

Materials and Methods: A comprehensive analysis of the Web of Science (WoS) database was conducted, encompassing articles published from 1980 to 2023. Keywords "uterine rupture" and "uterus rupture" were utilized. Data visualization was facilitated using Datawrapper, while VosViewer 2019 was used to analyze coauthorship and citation networks.

Results: A total of 5.828 publications were identified, of which 5.745 were analyzed after excluding studies from 2024. The United States, England, and France emerged as the top contributing countries. The American Journal of Obstetrics and Gynecology was the leading journal. The publication rate has steadily increased, peaking in 2020. The most cited article, "risk of uterine rupture during labor among women with a prior cesarean delivery" reflects ongoing concerns in obstetric care. Collaborations between researchers and institutions are evident, with significant networks formed around key authors.

Conclusion: Uterine rupture remains a pressing clinical issue, increasingly prevalent due to rising cesarean rates. Emergency physicians and obstetricians should understand the risk factors and diagnostics. Continued growth in research publications is anticipated, with a focus on multidisciplinary approaches to enhance understanding and management strategies for uterine rupture.

Keywords: Uterine rupture, emergency medicine, gynecology, bibliometrics

Introduction

Uterine rupture is represents a serious gynecological and obstetric emergency linked to considerable maternal and perinatal complications and fatalities. Clinically, uterine rupture is defined as a complete tear through the uterine layers, including the parietal peritoneum. The incidence of peripartum uterine rupture ranges from 1 in 280 to 12.000 births, often leading to fetal death due to hemorrhage, the need for hysterectomy, and potentially maternal death [1]. In the United Kingdom (UK), it is reported in 0.2% of patients attempting vaginal birth after cesarean section and in 2 out of 10.000 of all births [2]. Perinatal risks associated with uterine rupture include damage to a cesarean scar and use of prostaglandins for labor induction [3].

Uterine rupture typically presents with signs such as fetal distress, maternal abdominal pain, and hypovolemic shock. Emergency intervention may require a laparotomy, cesarean delivery, scar repair, or hysterectomy. In some delayed cases, the fetus, placenta, and hematoma may be located in the abdominal cavity. Uterine scar dehiscence, a milder form of uterine rupture characterized by the partial separation of a preexisting uterine scar, is more common but less dangerous, rarely leading to significant fetal or maternal complications. Unlike full rupture, uterine scar dehiscence does not involve the overlying visceral peritoneum and typically does not result in significant bleeding. Moreover, in cases of dehiscence, the fetus, placenta, and umbilical cord remain contained within the uterine cavity.



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Uterine rupture can also be caused by gynecological causes. Prior surgeries, such as myomectomy, hysteroscopic procedures, and adenomyoma excision, may weaken the uterine wall, leading to rupture in the scar area, with or without pregnancy. Advances in the imaging of cesarean scars, including assessments of uterine wall thickness and the identification of hypoechoic areas, have led to the introduction of the term “isthmocele” [4]. Proper surgical techniques during cesarean delivery can help reduce the incidence of uterine rupture, dehiscence, and ischiocele formation.

The clinical manifestations of uterine rupture vary according to the size and depth of the rupture. Patients may experience symptoms ranging from atypical lower abdominal pain to severe abdominal discomfort and from mild intra-abdominal hemorrhage to hematoma formation and hypovolemic shock. Research on the obstetric and gynecological causes, treatments, and follow-up protocols for uterine rupture is increasing, with an increasing number of publications annually. The objective of this study was to perform a comprehensive bibliometric analysis of academic articles on uterine rupture.

Materials and Methods

Our study utilized the Web of Science (WoS) database, incorporating sources such as the Korean journal database, the core collection index, the Russian Science Citation Index, and the Scientific Electronic Library Online citation index. We analyzed articles indexed between 1980 and 2023, deliberately excluding studies from 2024. This exclusion was made because the year 2024 is still in progress, and a complete view of its publications cannot yet be determined. Consequently, the citation metrics, publication frequencies, and impact factors for this year remain provisional. Including incomplete data from an ongoing year could introduce inconsistencies, thereby affecting the accuracy and comparability of trends across a stable time frame. The keywords “uterine rupture” and “uterus rupture” were employed during the database search. To visualize global research productivity, we employed the free open web-based application Datawrapper. The VosViewer 2019 software was used to evaluate the scientific significance of the obtained data.

This study analyzes the published literature on uterine rupture through a bibliometric approach, focusing on the characteristics of the reports. Bibliometric studies in medicine generally do not require ethical approval because they do not involve direct interaction with human participants, collection of personal data, or clinical interventions. Instead, they rely on publicly available data, such as published articles, citation metrics, and other scientific outputs, which pose no risk to individual privacy or welfare. Consequently, these studies fall outside the ethical review guidelines applicable to research involving human subjects.

Statistical Analysis

The statistical analysis for this bibliometric study was performed using descriptive and inferential methods to summarize and interpret the data retrieved from the WoS database. Descriptive statistics, such as frequencies, percentages, and averages, were used to quantify publication trends, citation metrics, and authorship patterns. Additionally, inferential techniques, such as regression analysis, were employed to identify significant trends over time and correlations between variables like publication year, citation counts, and journal impact factors. These methods ensured a robust and systematic evaluation of the bibliometric data.

Results

Overview of Characteristics and Worldwide Output: By examining the WoS database using the keywords “uterine rupture” and “uterus rupture”, we found a total of 5.828 publications. In our study, we excluded 339 studies from 2024 because their citations were not yet complete. The remaining 5.745 articles published prior to 2023 were analyzed, with the first article dating back to 1980. This initial article examined the relationship between the use of hyperosmolar urea and prostaglandin in mid-trimester pregnancy abortion and uterine rupture [5]. The articles were published in 21 different languages, with English as the most prevalent, accounting for approximately 92.7% of all publications.

The majority of the documents (77.6%) were research articles, followed by reviews and meeting abstracts (Table 1). An analysis of the distribution of documents related to uterine rupture across scientific fields revealed studies in 40 different areas, with obstetrics and gynaecology being the most researched branch, comprising 64.1% of all documents. Subsequently, reproductive biology, emergency care, surgery, respiratory medicine, and medical imaging in radiology followed (Table 2). The number of publications related to uterine rupture has been increasing each year, with a significant increase starting

Table 1. Publication types of uterine rupture literature between 1980-2022		
Research areas	Number of publications	% of 5745
Article	4463	77.6
Review	566	9.8
Proceedings paper	234	4.1
Letter	218	3.7
Editorial material	201	3.4
Meeting mbstracts	179	3.1
Note	49	0.8
Book mhapter	26	0.5
Early access	15	0.2
Corrections	8	0.1

in 1998. This trend culminated in 2020, with a record 383 publications, the majority being research articles (Figure 1). The most cited research article during this period was titled “risk of uterine rupture during labor among women with a prior cesarean delivery” published in the New England Journal of Medicine [6]. Upon evaluating the citations of documents related to uterine rupture, we found that the highest number of citations occurred in 2022. Among the articles published in the last 5 years, the most cited was “short-term and long-term effects of cesarean section on the health of women and children”, which was published in The Lancet [7]. In total, 3,680 articles on uterine rupture have been published in the field of obstetrics and gynecology, with 885 of these articles appearing in the American Journal of Obstetrics and Gynecology, Obstetrics and Gynecology, and the Journal of Maternal-Fetal & Neonatal Medicine. The year 2022 was the most cited article on uterine rupture published in the American Journal of Obstetrics and Gynecology, with the most cited article being “incidence, risk factors, and temporal trends in severe postpartum hemorrhage” [8] (Figure 2).

We evaluated the countries responsible for publishing articles on uterine rupture and identified the USA, England, and France as the most productive countries. Approximately 27.0% of all publications originated from the United States

Table 2. The top 10 research areas of documents in uterine rupture according to the Web of Science database between 1980-2022		
Research areas	Number of publications	% of 5745
Obstetrics and gynecology	3680	64.1
General internal medicine	752	13.1
Reproductive biology	427	7.4
Pediatrics	269	4.6
Radiology	250	4.3
Surgery	217	3.77
Public environmental and occupational health	149	2.5
Experimental medicine research	96	1.6
Multidisciplinary science	65	1.1
Emergency medicine	34	0.5

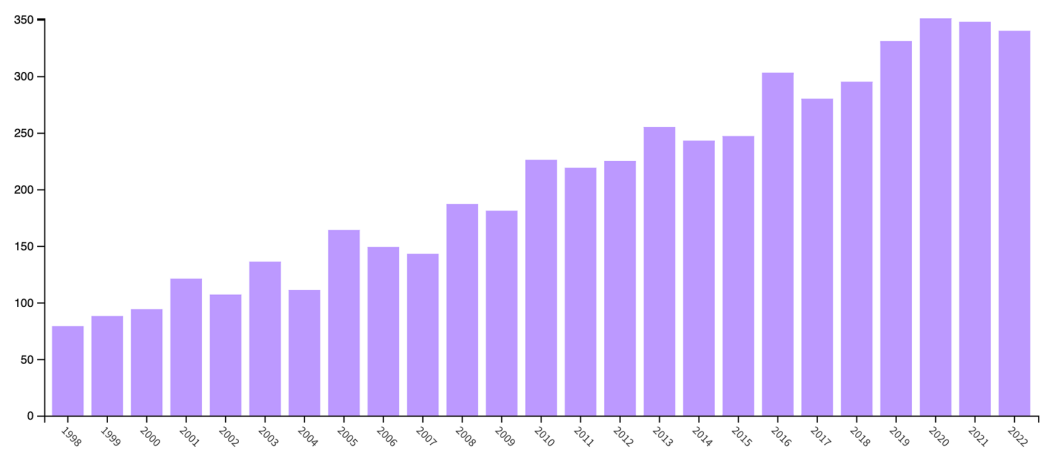


Figure 1. Graph of publications about uterine rupture by year

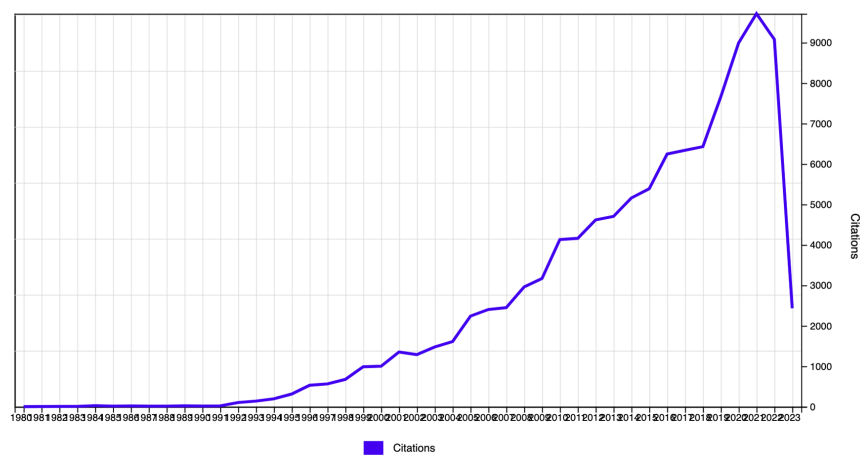


Figure 2. Graph of citations about uterine rupture by year

(Figure 3). We noted that the productivity of African and Central Asian countries regarding uterine rupture is relatively low, with the most productive countries being North America and Europe (Figure 4).

Productivity of Authors and Institutions: We compared author productivity, institutional output, and the h-index. Bujold E from Laval University, Canada was identified as the most productive researcher. The 10 most productive authors and countries are presented in Table 3. Furthermore, we compared the productivity of universities and organizations in the WoS database. The University of Texas System emerged as the most productive institution, with 127 publications (2.05%) in the field of uterine rupture (Figure 5).

Authorship and Institutions Co-citation: A co-citation analysis revealed that 44.708 authors have investigated uterine rupture. Organizations that published at least 10 documents and received 10 citations were classified, with 146 out of 4.949 organizations meeting these criteria. Among these, Wayne State University (USA) was identified as the most active. Collaboration and citation networks were noted between

Wayne State University, Ohio State University, and University of Texas. Additionally, organizations from EU countries demonstrated collaborative efforts centered around the UK (Table 4, Figure 5).

In evaluating authors' collaborations, a total of 20.195 authors with at least 10 publications on uterine rupture were identified. After filtering, 67 active authors were identified, and their collaborative efforts were assessed. A clustering of collaboration around five active authors was observed, with Margaret Harper, Emmanuel Bujold, and Catherine Spong being the most collaborative (Figure 6).

Significant Publications: Articles concerning uterine rupture were reviewed, focusing on the most cited works, average citations per year, authors, and publishers. The document authored by Lydon-Rochelle, M. titled “risk of uterine rupture during labor among women with a prior cesarean delivery” ranked first in total citations and average citations per year [9]. The 10 most cited articles are listed in Table 5. The Citation relationships among the articles reflected the publishing trends and author preferences. A yearly examination of

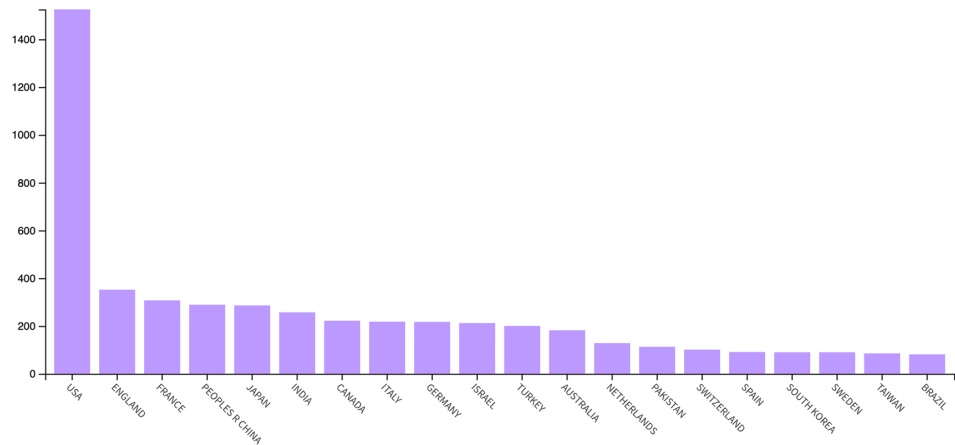


Figure 3. The top ten publishing country charts on uterine rupture

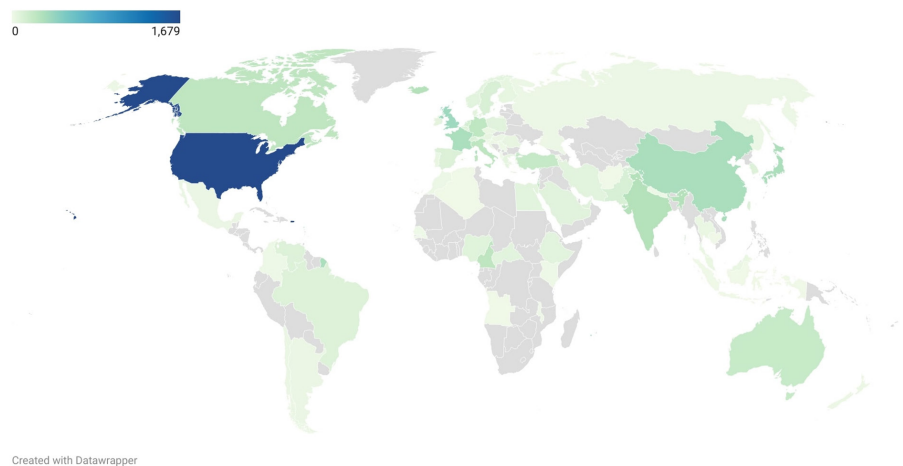


Figure 4. Uterine rupture publication density according to the countries

Table 4. The top 10 funding organizations by number of uterine rupture literature		
Institutions	Number of Publications	% of 5745
United States department of health human services	215	3.7
National institutes of health, USA	197	3.2
Nih Eunice Kennedy Shriver, National Institute of Child Health, Human Development	133	2.3
National Natural Science Foundation of China	34	0.5
Canadian Institutes of Health Research	33	0.5
National Health and Medical Research Council of Australia	29	0.3
National Institute for Health Research	21	0.3
Ministry of Education Culture Sports Science and Technology Japan	19	0.3
Japan Society for the Promotion of Science	18	0.2
United Kingdom Research Innovation	18	0.2
USA: United States of America		

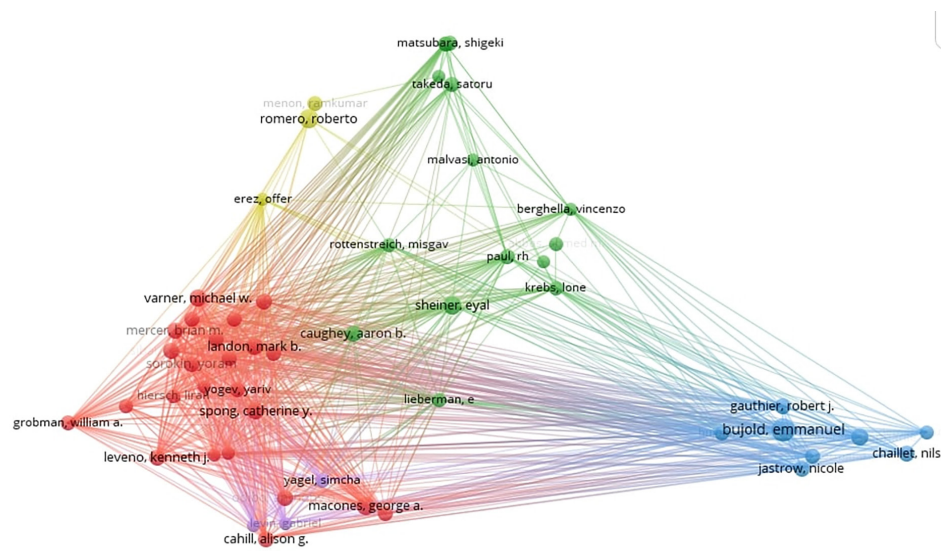


Figure 6. Network visualization map of co-citation analysis of active authors

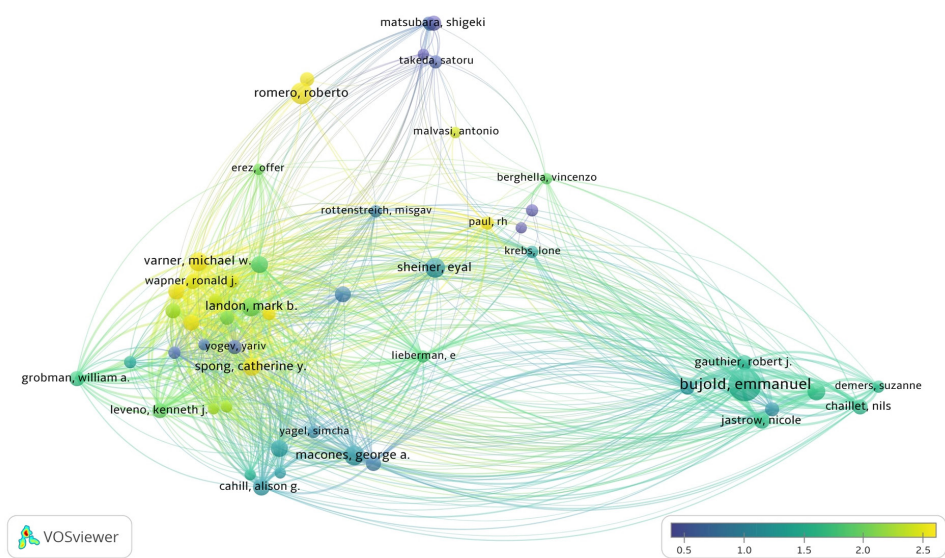


Figure 7. Network visualization map of co-citation analysis of most cited documents

Table 5. The top 10 most cited manuscripts about uterine rupture

No	Article	Author	Journal Name/Published	TC	ACY
1	Risk of uterine rupture during labor among women with a prior cesarean delivery.	Lydon-Rochelle, M., Holt, V. L., Easterling, T. R., and Martin, D. P.	New England Journal of Medicine, 2001	573	24.9
2	Incidences and predictors of severe obstetric morbidity: case-control study	Waterstone, Mark J. Deirdre Murphy, Susan Bewley, and Charles Wolfe.	BMJ, 2001	476	20.7
3	Comparison of a trial of labor with an elective second cesarean section	McMahon, M. J., Luther, E. R., Bowes Jr, W. A., & Olshan, A. F.	New England Journal of Medicine, 1996	457	16.3
4	Cesarean scar ectopic pregnancy: etiology, diagnosis, and management	Wittstein, IS; Thiemann, DR; Lima JAC; et al.	New England Journal of Medicine, 2005	406	22.5
5	Cesarean scar pregnancy: management issues	Seow, K. M., Huang, L. W., Lin, Y. H., Yan-Sheng Lin, M., Tsai, Y. L., Hwang, J. L.	Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology	391	19.5
6	Incidence, risk factors, and temporal trends in severe postpartum hemorrhage	Kramer, MS; Berg, C; Abenheim H, et al.	American Journal of Obstetrics and Gynecology, 2008	365	33. 1
7	Cesarean scar pregnancy	Ash A; Smith A and Maxwell D.	BJOG International Journal of Obstetrics and Gynecology, 2007	358	21.44
8	Uterine rupture after previous cesarean delivery: maternal and fetal consequences	Leung, A.S.; Leung, E.K.and Paul, R.H.	American Journal of Obstetrics and Gynecology, 1993	234	7.31
9	Maternal complications of vaginal birth after cesarean delivery: a multicenter study	Macones GA; Peipert K; Nelson DB; et al	American Journal of Obstetrics and Gynecology 2005	215	10.75
10	WHO systematic review of maternal mortality and morbidity: the prevalence of uterine rupture	Hofmeyr GJ; Say L; Gulmezoglu AM	BJOG International Journal of Obstetrics and Gynecology, 2005	211	10.55

TC: Total citation, ACY: Average citations per year

Table 6. The first 15 journals by number of publications and citations on uterine rupture

Journal Name	No	% of 5828	JIF
American Journal of Obstetrics and Gynecology	383	6.2	8.8
Obstetrics and Gynecology	305	4.9	7.2
Journal of Maternal Fetal Neonatal Medicine	181	2.9	1.8
European Journal of Obstetrics Gynecology and Reproductive Biology	178	2.8	2.3
BJOG an an International Journal of Obstetrics and Gynecology	145	2.3	5.9
International Journal of Gynecology and Obstetrics	144	2.1	3.5
Archives of Gynecology and Obstetrics	133	2.0	2.3
ACTA Obstetrica et Gynecologica Scandinavica	126	1.7	2.6
Journal of Reproductive Medicine	108	1.7	0.2
Journal of Obstetrics and Gynecology Research	107	1.6	1.2
BMC Pregnancy and Childbirth	104	1.6	3.4
Journal of Obstetrics and Gynecology	99	1.4	1.3
Journal of Minimally Invasive Gynecology	91	1.2	1.3
Ultrasound in obstetrics and gynecology	79	1.1	6.4
Australian New Zealand Journal of Obstetrics Gynecology	73	1.1	1.7

No: Number of publications; JIF: Journal impact factor

medicine”, and “hyperstimulation” were also identified as closely related to uterine rupture. The most commonly repeated clinical analyses in the literature included cesarean section, postpartum hemorrhage, and maternal mortality (Figure 10).

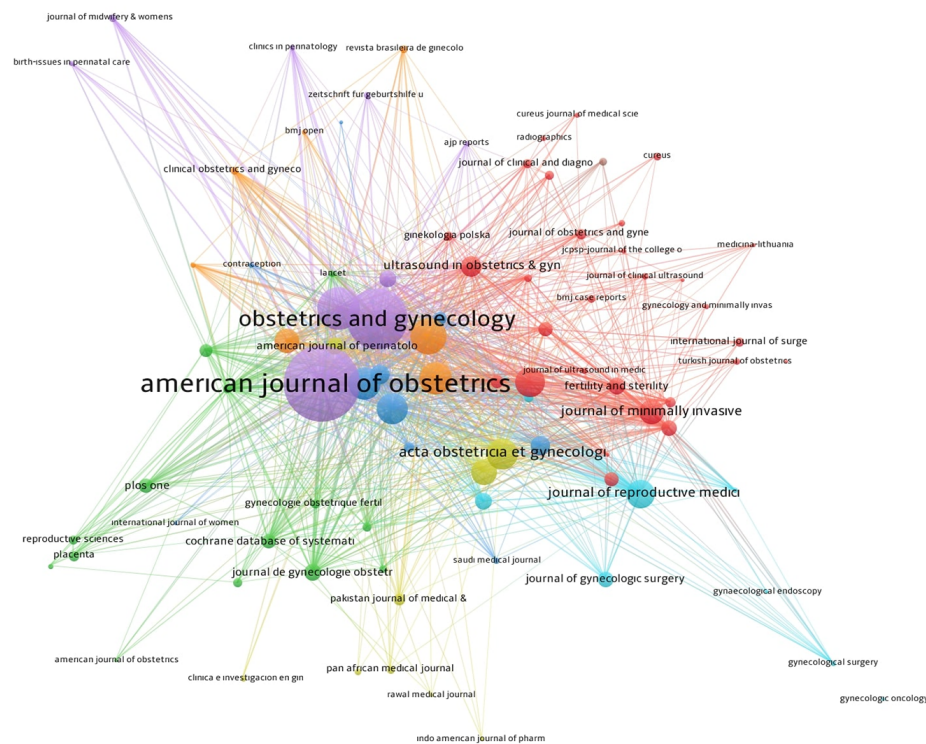


Figure 8. Network visualization of productivity of journals

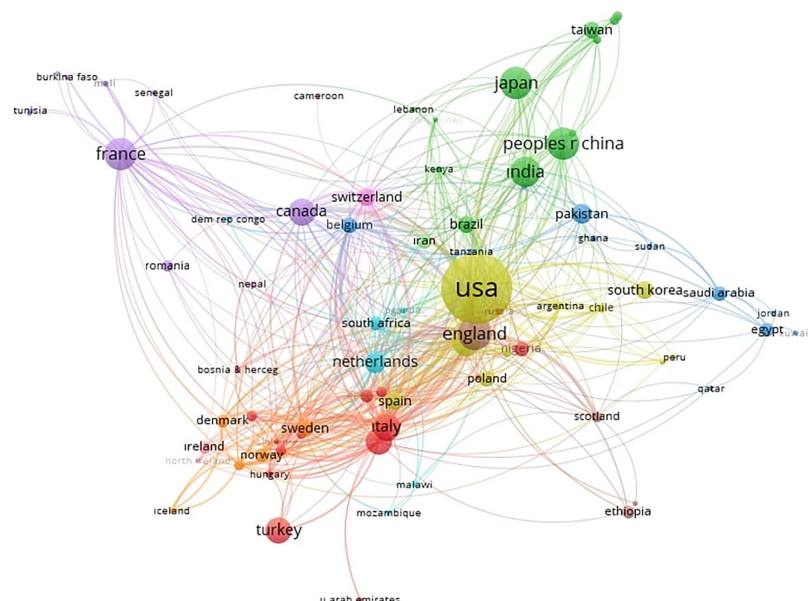


Figure 9. Network of co-contributing / collaborative countries on uterine rupture

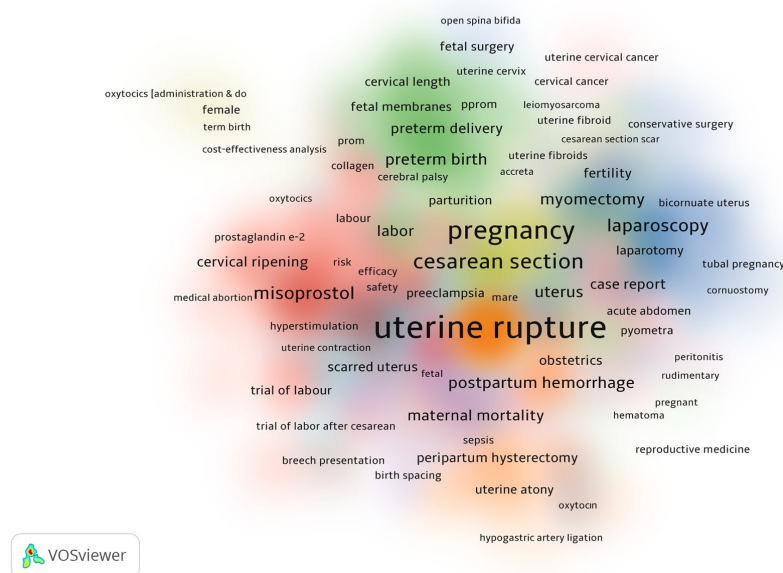


Figure 10. Network visualization map of relationships between the most commonly used trends keywords

Discussion

In our article, we conducted a bibliometric analysis of articles on “uterine rupture” in the WoS database. We reached a total of 5828 articles and reviewed the citations of these articles, the most active researchers, and the most active journals. The most active country was the United States. The most active researcher was Bujold, and the most active journal was the American Journal of Obstetrics and Gynecology. The most productive year was noted as 2020. The most cited study was “risk of uterine rupture during labor in women with a previous cesarean delivery”, a population-based, retrospective cohort analysis. The most cited study in the last three years is a meta-analysis published in BMC childbirth and pregnancy evaluating the use of oxytocin for uterine rupture in patients undergoing vaginal birth after cesarean section [9]. The etiology, diagnosis, and management of uterine rupture is multidisciplinary, and the medical team that first evaluates this symptom typically consists of obstetricians or emergency medicine specialists. The diagnosis of uterine rupture is challenging because of nonspecific uterine contractions, fetal movements, and atypical bowel movements during pregnancy [10]. Uterine rupture may cause acute abdominal symptoms, and this condition is triaged by emergency room specialists before obstetricians in emergency settings [11]. The types of uterine rupture may vary upon presentation to the emergency department (ED). For instance, full-thickness uterine rupture may occur in the ED without rupture of the membranes. Emergency physicians should maintain a presumptive diagnosis of uterine rupture in patients presenting with acute abdominal symptoms, regardless of gestational age. A holistic medical approach is required to diagnose uterine rupture.

In addition to a complete history and examination in the ED, the correct use of imaging methods is also essential [12]. Uterine rupture is a clinical condition that has increased in frequency over the years, necessitating urgent diagnosis and intervention by obstetricians and emergency service clinicians. Factors contributing to this increase include higher rates of labor induction with oxytocin, scarred uteri from previous cesarean delivery, and labor induction using prostaglandins or prostaglandins combined with oxytocin [13]. Uterine rupture can range from dehiscence to full-thickness rupture. Clinical conditions on this scale may vary according to risk factors. The probability of developing full-thickness uterine rupture increases with vaginal delivery after cesarean section, pregnancy in women with a parity of 3 or more, and labor induction using oxytocin [14].

The triage of patients with uterine rupture in emergency services and obstetrics and gynecology clinics is based on the principles of thoroughly taking the patient’s medical history, conducting a physical examination, providing rapid monitoring, performing obstetric and abdominal imaging, and utilizing appropriate tests [10]. The most significant risk factor for uterine rupture, as agreed upon by gynecology and obstetrics associations, is scarring caused by uterine surgical procedures. Factors such as the number of scars, size, incision shape, and repair technique are determinants of potential rupture. Therefore, an obstetric history during patient triage is necessary to identify risk factors [15].

Uterine rupture may develop silently or may present as progressively increasing pain. This pain may occur alongside uterine contractions in women during labor, but it can sometimes manifest as persistent pain independent

of contractions. Persistent abdominal pain (present at all times, even outside of contractions, and intensifying during contractile activity) is the clinical presentation most commonly associated with uterine rupture. Symptoms indicative of full-thickness uterine rupture include persistent uterine bleeding, increased pain with contractions, a non-reassuring non-stress test, and a shift in the level of the fetus and placenta toward the abdomen.

Dehiscence or full-thickness rupture may lead to bleeding that dissects between the anterior uterine wall and the posterior bladder wall, causing urinary system complaints and hematuria. Patients experiencing urinary complaints should be evaluated during sonogram. Repeat sonographic evaluation may be necessary in the ED or upon hospitalization. This approach facilitates early diagnosis of the need for emergency laparotomy. Hemodynamic instability detected during patient evaluation may be an indication for emergency laparotomy [16,17].

Imaging methods for evaluating uterine rupture should be selected based on indication for emergency delivery. For patients with a history of uterine surgery, evaluation of the uterine wall is beneficial in establishing a clinical diagnosis. The detection of hemoperitoneum, pneumoperitoneum, uterine heterogeneity, and abscess formation on imaging may be associated with uterine rupture [18]. Ultrasonography can play a diagnostic role by demonstrating the hemoperitoneum and free fluid in the abdominal cavity where the fetal parts and their appendages are partially or completely expelled. Sonographic evaluation is typically the first-choice method for assessing uterine rupture due to its advantages, such as cost-effectiveness, ease of application, bedside applicability, and absence of ionizing radiation. The sonogram can easily identify the area of uterine rupture, assess fetal health, and estimate the volume of abdominal bleeding [19].

Transabdominal transducers are effective in visualizing intra-abdominal fluid and hematomas from a broader angle, whereas transvaginal use is more effective for visualizing uterine dehiscence and rupture areas. Color doppler and 3D sonograms can be used to visualize the active bleeding area and estimate the myometrial bleeding area. Sonograms are also frequently used to guide percutaneous diagnostic procedures [20].

Computed tomography (CT) can assist in the differential diagnosis when sonograms inadequately visualize the condition, in cases where the operator cannot diagnose, and in clinical situations that present similar symptoms. When sonography is inconclusive in diagnosing rupture during pregnancy, abdominal CT can be performed, considering the benefits and risks [21]. Compared with CT, sonography is advantageous for providing a broader view in evaluating intra-abdominal organs, visualizing pneumoperitoneum,

offering multi-planar section capabilities, and enabling contrast applicability [22]. Magnetic resonance imaging (MRI) has limited utility in uterine rupture; it is generally reserved for clinically stable patients and should not delay urgent interventions. MRI is typically used in challenging cases and serves as a problem-solving tool when sonography and CT are inconclusive, especially when the suspicion of uterine injury is high [23].

The timing of intervention after the diagnosis of uterine rupture is critical. Maternal history and fetal intrapartum status may not reliably predict uterine rupture. Fetal mortality and morbidity increase as the duration of fetal bradycardia to cesarean delivery lengthens [24]. When uterine rupture is detected intrapartum or during pregnancy, the fetal status and maternal hemodynamics are the most critical factors determining the management of the rupture. Limited cases of uterine repair and pregnancy continuation have been reported when rupture or dehiscence was detected in second-trimester pregnancies. In cases involving hemodynamically unstable patients or those with fetal morbidity and mortality, laparotomy typically results in subtotal or total hysterectomy, with occasional hypogastric artery ligation performed [25,26].

Conclusion

Uterine rupture is a clinical challenge that is likely to become increasingly prevalent in the future, primarily due to rising rates of cesarean section and uterine surgery. Emergency physicians and obstetricians should be well-versed in the risk factors and diagnostic methods associated with uterine rupture. A comprehensive examination of existing studies reveals a steady annual increase in research on this topic, suggesting that high publication rates will persist, with future publications expected to achieve significant citation and impact. While there is a wealth of case reports and clinical studies focusing on risk factors and management, there remains a notable scarcity of meta-analyses and compilations that adopt a multidisciplinary approach. It is anticipated that the volume of research evaluating uterine rupture will continue to grow in the future, with an emphasis on integrating multidisciplinary strategies.

Ethics

Ethics Committee Approval: Not required

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.Y., H.S.Ö., Concept: E.Y., H.S.Ö., Design: E.Y., H.S.Ö., Data Collection or Processing: E.Y., Analysis or Interpretation: E.Y., Literature Search: E.Y., H.S.Ö., Writing: E.Y., H.S.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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