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Incidence and risks of caesarean section in women aged ≥ 40 years

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ABSTRACT

Objective. Evaluating the rates of childbirth in women over 40 years of age in Tuscany (Italy) outlining the indications for caesarean section in this parturient population.

Methods. 227,871 women who delivered in Tuscany from 2011 to 2018 using data of Birth Assistance Certificate linked with hospital discharge registry were observed. Caesarean section indications were reported as dismissal diagnoses. Logistic models (adjusted for parity, ART and BMI) were carried out for the maternal age risk factor.

Results. The caesarean section rate increases significantly with age. Multivariate analysis confirmed that women over 40 years of age have a higher risk of a caesarean section due to pathologies such as diabetes or eclampsia which are clearly more frequent in these categories of women. Furthermore, the data shows that the caesarean section in some cases was carried out due solely to the age of a primiparous woman.

Conclusions. The phenomenon affects health services and social costs and should make us reflect upon the underlying reasons that bring women to delay their reproductive project and where necessary implement appropriate political strategies.

SOMMARIO

Scopo. Valutare il parto nelle donne over 40 in Toscana e descrivere le indicazioni al taglio cesareo in questa popolazione.

Metodi. Da Certificato di Assistenza al Parto linkato con la SDO sono state estratte 227.871 donne che hanno partorito in Toscana tra il 2011 e il 2018. Attraverso le diagnosi di dimissione è stato possibile identificare le principali indicazioni al cesareo. Per queste sono stati effettuati dei modelli logistici (univariati e multivariati aggiustati per parità, PMA e BMI) per il fattore di rischio età materna.

Risultati. Aumenta significativamente all'aumentare dell'età il ricorso al taglio cesareo, soprattutto quello di elezione e quello in urgenza, a testimonianza di una maggiore incidenza di condizioni patologiche. L'analisi multivariata conferma per le over 40 un rischio maggiore di taglio cesareo a causa di patologie come il diabete o l'eclampsia che risultano chiaramente più frequenti in queste categorie di donne. I dati mostrano inoltre che in alcuni casi il cesareo viene effettuato solo per indicazione materna.

Conclusioni. Questo incide sui servizi sanitari e sui costi sociali e dovrebbe fare riflettere sulle motivazioni che conducono le donne a ritardare il loro progetto riproduttivo mettendo in atto scelte politiche conseguenti e adeguate.

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Key words:

Pregnancy; caesarian section; diabetes; eclampsia; maternal indications; advanced maternal age.

INTRODUCTION

In recent decades, there has been a tendency for women in developed countries to postpone their reproductive plans to an older age (1-3). The phenomenon is multifactorial and a combination of medical, cultural and social components (4-6): contraceptive methods availability; achievement of higher levels of education by women; entrance of women into typically male working environments where maternity is not sufficiently supported. Furthermore, cultural changes that make women not feel ready to have a child at a young age and lack of employment policies and social networks to support working women may also play a role. Other circumstances are represented by economic instability in relationships, and the availability of assisted reproduction treatments. With adequate prenatal care it is possible for older women to have successful pregnancies with a generally favourable outcome comparable to that of young women. Most women who have a single spontaneous pregnancy at 43 or older have a successful pregnancy outcome. However, compared to women of younger age, they have significantly higher risks of caesarean section and preterm birth.

These risks increase significantly with *in vitro* fertilization and twin pregnancy among older women (1). The advanced maternal age is characterized by a greater risk of complications of maternal pregnancy such as hypertension, diabetes, and placental problems (7-9). According to Eurostat data (10), Italy holds the European record of women with the first child at 40 years of age (in 2017, 10.5% of women with the first child was at least 40 years old compared to the European average of 6%) and is one of the first countries in Europe where more than half of women conceive their first child after age 30. Tuscany is ranked sixth among the Italian regions for the largest proportion of over 40 childbirth (11). The aim of this study is to evaluate the phenomenon of childbirth in over 40 women in Tuscany and to describe in particular the reasons for caesarean sections in this population of parturients.

MATERIALS AND METHODS

The data sources used for the study were the Childbirth Assistance Certificate (Cedap) and the Nosological Card (SDO). We extracted from Cedap the women who gave birth in Tuscany in the period

2011-2018. A procedure of record linkage was carried out between the two archives Cedap and SDO to identify hospital admissions for giving birth. The record-linkage procedure was carried out using as the first key field the number of the clinical record present in the SDO archive, year of practice and birth-point code or as a second key field the general identification information of the woman. SDO allows identifying the primary discharge diagnosis and five additional diagnoses coded according to the International Classification of Diseases, ninth review (ICD-9CM). Through the dismissal diagnoses after birth it was possible to identify the main indications for caesarean section: Previous c-section, Podalic fetus/abnormal position, Fetal stress, Multiple pregnancy, Dystocia, Failed induction, IUGR, Placental abruption, Diabetes, Eclampsia, Placenta abnormalities and Maternal indications. The codes that led to the classification of the caesarean section indications are reported in **table I**.

The analysis is divided by age of the woman: the two groups 40-42 years and 43 years and more in which the over 40 population is extracted are compared with women under 40 years of age and with the average for Tuscany. In descriptive analyses frequency distributions and the χ^2 test for comparison between the 3 age classes into which the study population is divided were used. Results were considered significant when $p < 0.05$.

Twelve individual multivariate logistic models using each of the CS indications as an outcome and age, parity, ART and BMI as independent variables were carried out. The 95% odds ratios and confidence intervals (CI) were calculated.

Statistical analysis was carried out with the statistical package STATA/SE, version 14.0.

RESULTS

During the study period the number of women over 40 who gave birth in Tuscany was 20214 (8.9% of all births that took place in the region): 7.4% in 2011, reaching 9.8% in 2018. At the same time, 4800 women were aged over 43 years at the moment of child-birth (2.1%).

Thirty-six percent of the 40-42-years old experienced their first birth and adding the women aged 43 and over the rate rises to 46.7%. These women are employed in a higher proportion than the younger ones and have a higher educational qualification. The proportion of foreign mothers in the

Table I. Codes used to classify the main indication for caesarean section.

Indication for caesarean section	Code (ICD-9CM)
Previous c-section	65420, 65421, 65423
Podalic fetus/abnormal position	65201, 65203, 65210, 65211, 65213, 65220, 65221, 65223, 65231, 65233, 65241, 65243, 65251, 65253, 65283, 65291, 65441, 65442, 66001, 6961
Fetal stress	64403, 64410, 64420, 65371, 65451, 65501, 65531, 65541, 65571, 65581, 65591, 65601, 65611, 65621, 65630, 65631, 65633, 65641, 65681, 65841, 65970, 65971, 65973, 66131, 66141, 66300, 66301, 66310, 66311, 66313, 66321, 66323, 66341, 66380, 66381, 66980, 7424
Multiple pregnancy	65100, 65101, 65103, 65111, 65121, 65131, 65141, 65161, 65171, 65181, 65191, 65193, 65261, 66051, V272
Dystocia	2189, 65271, 65301, 65341, 65343, 65350, 65351, 65353, 65361, 65381, 65391, 65411, 65412, 65413, 65461, 65471, 65481, 65661, 65663, 65703, 65830, 65831, 66000, 66003, 66010, 66011, 66013, 66020, 66021, 66030, 66031, 66033, 66040, 66041, 66071, 66080, 66081, 66083, 66090, 66091, 66093, 66140, 66143, 66190, 66191, 66200, 66201, 66203, 66210, 66211, 66213, 66220, 66221, 66223
Failed induction	64510, 64511, 64513, 64520, 64521, 64523, 65810, 65813, 65820, 65821, 65823, 65900, 65901, 65910, 65911, 65913, 66060, 66061, 66063, 66100, 66103, 66110, 66111, 66121, 66123
IUGR	65650, 65651, 65653, 65691, 76490
Placental abruption	64121, 64123
Diabetes	64800, 64801, 64802, 64803, 64881, 64882, 64883, 64884
Eclampsia	64091, 64200, 64201, 64202, 64203, 64212, 64213, 64221, 64223, 64231, 64232, 64233, 64241, 64242, 64251, 64252, 64254, 64260, 64261, 64262, 64271, 64291, 64292, 64293, 64294, 64611, 64613, 64671, 66920, 66921
Placenta abnormalities	6266, 64081, 64101, 64103, 64110, 64111, 64113, 64131, 64181, 64191, 64211, 64230, 64243, 64253, 64263, 64673, 65281, 65671, 66351, 66602
Maternal indications	389, 42, 5410, 7811, 7950, 1715, 1745, 1888, 1889, 1890, 220, 2375, 2382, 2449, 2452, 2699, 29544, 29622, 30000, 30020, 30029, 30562, 3080, 3310, 3312, 34201, 3499, 3510, 3619, 36210, 3671, 3870, 41071, 4111, 4211, 4270, 4281, 42821, 43401, 4467, 4549, 462, 4660, 485, 49121, 5118, 5185, 51881, 51884, 53101, 53500, 55090, 566, 56881, 5693, 56983, 5770, 5789, 5859, 591, 5921, 6183, 62211, 6288, 6390, 64321, 64621, 64631, 64641, 64661, 64662, 64701, 64721, 64731, 64741, 64761, 64762, 64781, 64783, 64791, 64793, 64794, 64811, 64812, 64821, 64822, 64823, 64831, 64841, 64843, 64851, 64852, 64861, 64862, 64871, 64872, 64873, 64911, 64914, 64921, 64931, 64941, 64942, 65311, 65321, 65331, 65401, 65403, 65460, 65462, 65463, 65521, 65920, 65921, 65931, 65950, 65951, 65961, 66491, 66561, 66632, 66801, 66811, 66821, 66881, 66883, 66900, 66901, 66902, 66903, 66910, 66911, 66912, 66923, 67111, 67122, 67131, 67191, 67202, 67204, 67301, 67401, 67410, 67451, 67452, 74781, 75249, 7566, 78025, 7806, 78551, 78559, 78650, 7880, 78900, 81201, 81340, 82020, 86519, 9051, 9896, V1249, V261, V5805, V5811, V581, V621, V719

over 40 age group is significantly lower than that recorded in the overall total of mothers giving birth in Tuscany where this percentage is 27.6%.

Mothers over 40 years are slightly more overweight or obese when compared to younger mothers. Of the 40-42 years old 34.0% and 39.9% of the over 43 year age group had at least one miscarriage before giving birth compared to 17.8% of women aged under 40 years of age.

In the group of 40-42 years old and the group over 43 years 7.3% and 25.5 % respectively have used ART compared to 2.1% in the group of women aged under 40 years of age.

Pathological pregnancy occurred in 38.3% of the women 43 years or older compared to 27.9% of the 40-42 years old, and 19.9% of the women under 40 years of age.

The proportion of multiple births increases in women aged 40-42 compared to younger women and reaches 7.4% of the births in women over 43 years of age, also due to the greater use of ART. As a consequence of this, the women over 40 years old and especially those over 43 years of age give birth

to a greater share of preterm infants (< 37 weeks): 8.2% and 14.4% compared to the 6.2% that occurs in the group of women under 40.

The practise of caesarean section increases significantly with age (25.0%, 38.6% and 56.1% respectively in the three age groups considered), above all in the categories of both elective and urgency, reflecting a higher incidence of pathological conditions (**table II**).

The frequency distribution of the caesarean section indications classes was: previous CS (29.8%), podalic fetus/abnormal position (14.5%), fetal stress (13.6%), dystocia (11.1%), failed induction (5.9%), multiple pregnancy (5.0%), eclampsia (3.4%), maternal indications (2.6%), placenta abnormalities (2.5%), IUGR (2.2%), placental abruption (1.7%) and diabetes (1.5%).

In the women over 40 years of age, but especially those older than 43 years, pathologies such as eclampsia and diabetes (**table III**) emerge in a greater proportion when compared to the younger women. It is observed that in 7.8% of the cases the caesarean is carried out for maternal indication in

Table II. Socio-demographic characteristics of women who delivery in Tuscany by age groups (% , p-value) and comparison with the average regional data. Years 2011-2018.

Variabile	Age of the woman			p-value*	Total
	< 40	40-42	≥ 43		
Number of women	20765	15414	4800		227871
Primiparous (%)	53.1	36.4	46.7	< 0.0000	51.9
Unmarried (%)	39.5	35.8	37.0	< 0.0000	39.2
Employed (%)	63.4	77.6	76.9	< 0.0000	64.6
Foreigners (%)	29.2	12.0	10.9	< 0.0000	27.6
No academic qualifications or primary school (%)	27.6	19.4	20.6	< 0.0000	26.9
Previuos miscarriages (%)	17.8	34.0	39.9	< 0.0000	19.4
Obesity/overweight (%)	22.2	24.5	25.5	< 0.0000	22.4
ART use (%)	2.1	7.3	25.5	< 0.0000	2.9
Pathological pregnancy (%)	19.9	27.9	38.3	< 0.0000	20.8
Elective CS (%)	12.2	22.3	35.2	< 0.0000	13.4
CS during labour (%)	7.6	8.4	8.7	< 0.0000	7.7
Urgen CS (%)	5.2	7.9	12.2	< 0.0000	5.5
Multiple birth (%)	1.7	2.5	7.4	< 0.0000	1.8
Preterm birth (< 37 wks GA) (%)	6.2	8.2	14.4	< 0.0000	6.5

*The p value refers to the three age groups.

Table III. Caesarean section indications in women who delivery in Tuscany with caesarean section by age groups (% , p-value) and comparison with the regional average data. Years 2011-2018.

	Caesarean section deliveries					Caesarean deliveries Primiparous and single birth				
	Age of the woman				Total	Age of the woman				Total
	< 40	40-42	≥ 43	p-value*		< 40	40-42	≥ 43	p-value*	
Number of mothers with CS	48282	5464	2373		56119	22632	1926	1016	25574	25574
Previous c-section	29.5	35.3	23.2	< 0.0000	29.8	-	-	-	-	-
Podalic fetus/abnormal position	15.0	12.3	11.0	< 0.0000	14.5	22.1	19.8	15.1	< 0.0000	21.7
Fetal stress	14.1	10.9	9.9	< 0.0000	13.6	22.1	18.1	13.7	< 0.0000	21.4
Dystocia	11.6	9.0	6.7	< 0.0000	11.1	18.7	15.5	9.8	< 0.0000	18.1
Failed induction	5.9	5.4	6.7	0.098	5.9	10.9	12.5	12.3	0.115	11.0
Multiple pregnancy	4.7	5.3	11.4	< 0.0000	5.0	-	-	-		-
Eclampsia	3.2	4.1	6.2	< 0.0000	3.4	4.5	7.1	9.9	< 0.0000	4.9
Maternal indications	2.3	3.1	7.8	< 0.0000	2.6	3.5	5.6	14.6	< 0.0000	4.1
Placenta abnormalities	2.3	3.2	3.1	< 0.0000	2.5	2.7	4.0	3.6	0.003	2.8
IUGR	2.2	2.2	2.9	0.07	2.2	3.3	3.7	4.0	0.362	3.3
Placental abruption	1.7	1.5	1.1	0.04	1.7	2.1	2.2	1.4	0.22	2.1
Diabetes	1.4	1.8	3.1	< 0.0000	1.5	1.7	2.9	5.0	< 0.0000	2.0
Other	6.1	6.0	6.9	0.256	6.2	8.4	8.5	10.5	0.083	8.5

*The p value refers to the three age groups.

the over 43s and the rate rises to 14.6% if only single-birth primiparous women are considered.

As expected, the incidence of caesarean section increases with increasing maternal age for all CS indications, but especially for pathologies such as eclampsia and diabetes (table IV).

The multivariate logistic models on these 12 variables, adjusted for parity, BMI and ART show that while younger women have a higher risk of

having caesarean section following fetal stress or twin pregnancy, for women aged 40-42 and over 43 years old there is a greater risk for pathologies such as eclampsia and diabetes, a risk that increases significantly with increasing age. Women aged over 43 have a more than one and a half times greater risk of having caesarean section due to eclampsia (OR: 1.62; IC 95%: 1.33-1.98) than women younger than 40 years and a more than double risk

Table IV. Incidence (%) and risk of caesarean section by each CS indications with the age as risk factor. Years 2011-2018 (OR: IC 95%).

Indication for caesarean section	< 40			40-42			≥ 43		
	%	OR #	(IC 95%)	%	OR #	(IC 95%)	%	OR #	(IC 95%)
Previous c-section (%)	91.9	1.00	-	94.4	1.01	(0.93-1.09)	97.2	0.82	(0.72-0.94)
Podalic fetus/ abnormal position	98.1	1.00	-	97.7	0.94	(0.86-1.03)	98.9	0.83	(0.72-0.95)
Fetal stress	72.0	1.00	-	79.0	0.89	(0.81-0.97)	87.7	0.83	(0.72-0.97)
Dystocia	68.8	1.00	-	76.6	0.91	(0.82-1.00)	83.2	0.67	(0.57-0.80)
Failed induction	26.6	1.00	-	39.2	1.13	(0.99-1.29)	55.2	1.16	(0.97-1.40)
Multiple pregnancy	86.7	1.00	-	94.7	0.74	(0.64-0.85)	98.2	0.74	(0.63-0.86)
Eclampsia	39.5	1.00	-	55.9	1.33	(1.14-1.56)	70.7	1.62	(1.33-1.98)
Maternal indications	31.3	1.00	-	43.1	1.54	(1.30-1.83)	74.9	3.52	(2.93-4.23)
Placenta abnormalities	77.9	1.00	-	87.1	1.40	(1.18-1.65)	88.1	1.25	(0.97-1.62)
IUGR	45.3	1.00	-	59.8	1.04	(0.84-1.28)	80.3	1.21	(0.92-1.59)
Placental abruption	98.1	1.00	-	98.8	0.89	(0.69-1.13)	100.0	0.72	(0.47-1.09)
Diabetes	14.1	1.00	-	19.1	1.27	(1.01-1.60)	41.1	2.38	(1.83-3.11)

Adjusted for parity, ART and BMI; reference age category: < 40 years.

(OR: 2.38; IC 95%: 1.83-3.11) for diabetes. In addition, the maternal caesarean section indication is three and a half times more likely in women older than 43 years compared to the ones younger than 40 years (table IV).

DISCUSSION

Our data confirm the increased incidence of women aged over 40 years in Tuscany over the past 10 years (12). It is a population that most frequently turns to ART with a consequent greater frequency of multiple pregnancies and pregnancies at risk.

As it is also reported in other studies, there is a greater incidence of obstetric complications or medical conditions such as hypertension and diabetes (13, 14) for these women and especially for women over 43 years of age, risks intensified with increasing maternal age.

The greater recourse to medically assisted reproductive techniques and the greater incidence of maternal pathologies means that women over 40 years have a higher risk of caesarean section compared to those under 40 years (15-19). Above all,

the data show a higher frequency of emergency caesarean section in the group over 40 years as evidence of a greater incidence of pathological conditions (20). The over 40s in fact have a higher risk of a caesarean section due to pathologies such as diabetes or eclampsia which are clearly more frequent in these categories of women. Furthermore, the data show that the caesarean section could be carried out for maternal indication if the woman is an elderly primiparous woman (21-27).

The risks of caesarean section delivery, in addition to those immediate for maternal morbidity during childbirth, are also associated with a doubling of the risk of neonatal mortality (28).

This affects health services and social costs and should make us reflect upon the underlying reasons that bring women to delay their reproductive project and where necessary implement appropriate political strategies.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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