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GENERAL GYNECOLOGY

Evaluation of menstrual blood loss (MBL) by self-perception and pictorial methods and correlation to uterine myometrial pathology

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Abstract

Purpose Evaluating menstrual blood loss (MBL) in primary healthcare is challenging. Our study aimed to assess MBL using two methods: self-perception and pictograms (Pictorial Blood Assessment Chart—PBAC and Menstrual Pictogram superabsorbent polymer-c version—MP) in women undergoing transvaginal ultrasound (TVS).

Methods We enrolled 221 premenopausal women with spontaneous menstruation, no hormonal therapy, and no ongoing pregnancy. They were divided into four age groups (12–20, 21–30, 31–40, and 41–55 years). Women self-reported normal (NMB) or heavy menstrual bleeding (HMB) and filled out PBAC and MP. A PBAC score ≥ 150 and MP score ≥ 80 ml indicated HMB. TVS was conducted on all patients, recording any pelvic pathologies. We compared self-perception with pictograms across the cohort, age groups, and ultrasound findings.

Results Of the cohort, 50.2% reported normal periods and 49.8% heavy periods. No significant differences were found between self-perception and pictograms in identifying NMB and HMB across all groups. However, significant differences were observed between PBAC and MP scores for NMB (56.1% vs 41.2%, $p = 0.001$) and HMB (43.9% vs 58.8%, $p = 0.001$), particularly in the 31–40 age group. Significant differences in PBAC and MP scores were noted between age groups 12–20 and 41–55, and 31–40 and 41–55. No significant differences were found between self-perception and pictograms regarding ultrasound findings like adenomyosis, fibroids, endometrial pathology, and uterine congenital malformations.

Conclusion Self-perception could be a reliable method for describing MBL across all age groups and ultrasound findings. Given the complexity and potential errors in using pictograms, clinicians should consider relying on self-perception for assessing menstrual cycle quantity.

Keywords Heavy menstrual bleeding · Pictorial blood loss assessment · Menstrual pictogram · Transvaginal ultrasound

What does this study add to the clinical work

This study aims to improve the clinician's approach to the evaluation of menstrual blood loss in an outpatient setting. The use of self-perception alone could be a reliable method to describe the quantity of menstrual bleeding to avoid errors due to the erroneous compilation of the visual pictograms.

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Introduction

The evaluation of menstrual blood loss (MBL) during menstrual period is an important tool to determine how much gynecological pathologies, such as adenomyosis or uterine fibroids or hormonal disorders, could impact on women's well-being. About 10–35% of women report heavy menstrual bleeding (HMB) in childbearing age, and among these, only 5% consult a medical practitioner to identify their possible causes [1].

In 2011, *Munro* et al. [2] described the causes of abnormal uterine bleeding (AUB) in non-pregnant women of reproductive age using the PALM-COEIN classification system, approved by the International Federation of Gynecology and Obstetrics (FIGO). In this classification, the type of AUB and the normal or abnormal amount of MBL were not clearly defined. Only recently, FIGO classification referred to HMB with a better definition. [3].

In literature, HMB is defined as a blood loss > 80 ml per cycle [4]. HMB is known to be extensively under-reported [5]. This is largely due to inaccurate individual self-perception of MBL [6] and normalization of symptoms [5]. HMB sometimes results in severe anemia and discomfort that interfere with physical, emotional, social and women's quality of life. It is therefore clear that under-reporting of HMB is of concern and improving identification methods may lead to timely diagnosis and treatment options.

Over the years, several methods to evaluate the MBL have been developed. Semi-quantitative methods to assess MBL are the PBAC (Pictorial Blood loss Assessment Chart) and the new menstrual pictogram superabsorbent polymer-c version (MP) [7, 8].

The first PBAC was introduced in 1990 by Higham et al. [7] and it comprises a visual scoring system that depicts a graded series of soiled tampons and/or towels. The patient can directly record the number of her used feminine items and the degree to which they are bloodstained. PBAC is the most used method in literature to confirm HMB, and it showed the highest sensitivity and specificity using a cut-off of 150 [7]. The menstrual pictogram (MP), introduced in 2001, includes five diagrams (icons) depicting a graduated series of stained towels or tampons. Women fill in the MP each time a sanitary pads changes, choosing a pictogram icon that corresponds with the degree of sanitary product staining. It showed the highest performance in evaluating HMB using a cut-off of 80 ml [8].

The menstrual pictogram has subsequently been revalidated with superabsorbent polymer-c version containing products that are now commonly used [9].

Nowadays, the evaluation of MBL is still a problem in primary healthcare; in literature, self-perception not always correspond to the real blood loss [6], while other authors showed good agreement between self-perceived MBL and objective evaluation [10, 11]; moreover, currently available pictograms are not widely used in clinical practice.

From one side, the relevance of the condition is based on a woman's self-reported symptoms and their impact on quality of life (QoL); on the other side, self-perception of menstrual loss is unreliable [12].

Based on these considerations, the main aim of our study was to evaluate the amount of menstrual blood loss in a group of women with double evaluation: "Self-perception" or with the use of "Pictograms" (PBAC/revalidated MP, from here on referred to as MP) to evaluate whether personal perception alone is a reliable method to define the amount of blood flow.

Secondary aim was to correlate the assessment of MBL by self-perception and with the use of pictograms in patients with pelvic gynecological pathologies detected by transvaginal ultrasound (TVS).

Materials and methods

Setting and participants

This is a prospective observational study carried out at the Department of Surgical Sciences, Gynecological Ultrasound Unit of the University of Rome "Tor Vergata". From January to March 2023, 764 patients consecutively underwent transvaginal ultrasound evaluation (TVS). Inclusion criteria were premenopausal women with spontaneous menstruation, not on hormone therapy, with no ongoing pregnancy, and signed consent. Patients were excluded in case of postmenopause, pregnancy, ongoing hormonal treatment, and no signed consent.

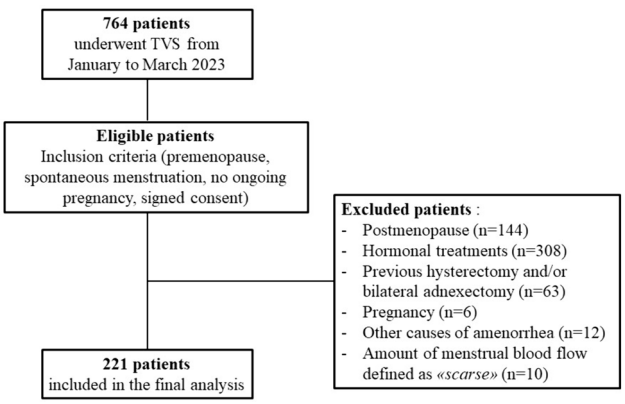

Fig. 1 Figure illustrates the study time frame, inclusion and exclusion criteria. A total of 221 patients were included in the analysis. TVS = transvaginal ultrasound

A total of 221 patients met finally the inclusion criteria (Fig. 1). The main indications for which patients underwent the ultrasound examination were fibroids (31/221, 14%), adenomyosis and endometriosis (54/221, 24.4%), menstrual cycle irregularities (61/221, 27%), heavy menstrual bleeding (30/221, 13.6%), infertility (23/221, 10.4%) and routine gynecological check (22/221, 10%).

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University of Rome "Tor Vergata" (Date 20.09.2022/No.167/22). Informed consent was obtained from all individual participants included in the study.

Clinical history and symptoms

Patient information was recorded according to a pre-established format using the File maker pro® software Version 9.0. The collected data included: age at the time of the ultrasound, body mass index (BMI), age of menarche, parity, menstrual cycle characteristics, any current or previous medical or hormonal treatments, comorbidities.

According to the last FIGO AUB System, we expressed the normal variation in cycle length (regular cycle) as ± 4 days. [3] Any deviation from this definition was considered as irregular cycle.

Patients were asked to describe their menstrual periods, and according to their subjective evaluation were divided in two group: "*normal menstrual bleeding*" and "*heavy menstrual bleeding*".

Patients with a defined "*scarce*" amount of MBL were excluded (Fig. 1).

We also asked for other pelvic painful symptoms, such as dysmenorrhea, dyspareunia, and chronic pelvic pain. Among the whole cohort, 41% (91/221) referred dysmenorrhea, 33.9% (75/221) dyspareunia and 64/221 (28.9%) chronic pelvic pain.

All participants, regardless of perceived menstrual flow, were instructed to fill in the two pictograms PBAC and MP. (Fig. 2A, B). [7, 8] A PBAC score ≥ 150 [7] and a MP score ≥ 80 ml [9] were considered to describe heavy menstrual bleeding, whereas a PBAC score < 150 and a MP score < 80 ml were considered to describe normal menstrual bleeding.

Ultrasound examination

All patients underwent transvaginal ultrasound examination in order to evaluate all possible pelvic pathologies.

The ultrasound examination was performed by an experienced sonographer (C.E.) using a Voluson E6 or E8 device (GE Healthcare, Zipf, Austria) with a transvaginal probe. The ultrasound settings were standardized and identical for all subjects. The scan was first involved with a conventional two-dimensional (2D) ultrasound assessment of the pelvis. Uterus, endometrium and adnexa were evaluated. The 2D examination was followed by a 3D acquisition of volumes using the 3D volume mode. The TVS examination was performed at any phase of the menstrual cycle.

All possible myometrial pathologies were described according to the Morphological Uterus Sonographic Assessment (MUSA) guidelines. [13, 14] Uterine fibroid's anatomical locations were classified according to the FIGO classification system [3]; to describe endometrial pathology, the International endometrial tumor analysis (IETA) terminology was used [15]. To describe ovarian pathologies,

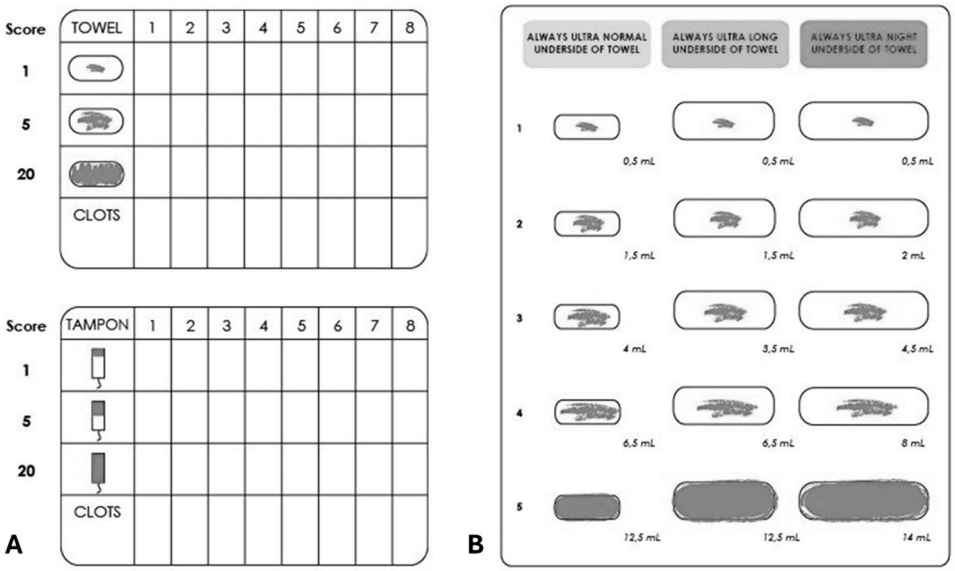

Fig. 2 **A**–**B** Graphic illustration of the two visual pictograms. (**A**) PBAC = Pictorial Blood Chart Assessment adapted from Higham et al. (1990). (**B**) MP = Menstrual Pictogram adapted from Magnay et al. (2014)

we used the International Ovarian Tumor analysis (IOTA) terminology [16].

Endometriosis and adenomyosis were recorded following the International Deep Endometriosis Analysis (IDEA) [17].

Statistical analysis

Statistical analysis was performed using SPSS V. 20.0 (SPSS. Chicago, IL, USA) and Prism software (GraphPad-9, San Diego, CA, USA). Categorical variables are reported as percentages and analyzed using the chi-square test. Continuous variables are expressed in terms of median and interquartile range. Multiple comparisons were analyzed using Kruskal–Wallis followed by Dunn's test as post hoc test. For all the analyses, a $p < 0.05$ was considered statistically significant and all tests were 2-tailed, unless otherwise indicated.

Results

Demographic and clinical characteristics of the 221 patients are described in Table 1.

The patients mean age was 35.5 ± 10.7-year-old (range 12–55 years).

Patients were divided into 4 groups, according to ranges of age. (Table 1) In our study population, only 11% (24/221) of patients were adolescents (Age Group 12–20).

The menarche's mean age was 12.0 ± 1.4 years old, with a rhythm of regular menstrual period for 42 patients (19%) and irregular for 179 patients (81%). In our study population, 131/221 patients (60%) were nulliparous.

In our cohort, 60/221 (27.1%) patients had a normal TVS finding, while the most represented pathological TVS finding was endometriosis (34/221, 15.4%), followed by uterine fibroids alone (32/221, 14.5%) and adenomyosis alone (29/221, 13.1%).

Table 2 showed the comparison between self-perception and pictograms and between both pictograms in the total population (Fig. 3) and in the different age groups; among the whole cohort, 111/221 (50.2%) patients considered their periods as normal and 110/221 (49.8%) as heavy.

We observed no statistically significant differences between self-perception and the use of both pictograms in describing normal and heavy menstrual bleeding in the total population and also in the different age groups (Table 2).

Conversely, we noticed statistically significant difference in comparing the evaluation of MBL using the two pictograms (PBAC and MP) in the total population both for normal menstrual bleeding (124/221, 56.1% vs 91/221, 41.2%, $p = 0.001$) and heavy menstrual bleeding (97/221, 43.9% vs 130/221, 58.8%, $p = 0.001$).

In particular, this statistical difference was observed in the age group 31–40 years, both for normal (38/67, 56.7% vs 25/67, 37.3%, $p = 0.02$) and heavy menstrual bleeding (29/67, 43.3% vs 42/67, 62.7%, $p = 0.02$).

Table 1 Characteristics of our study population ($n = 221$)

Patient characteristics ($n = 221$)	Mean (±) SD n (%)
Age (years)	35.5 ± 10.7
Group Age 12–20	24 (10.9%)
Group Age 21–30	53 (24.0%)
Group Age 31–40	67 (30.3%)
Group Age 41–55	77 (34.8%)
Body mass index (Kg/m^2)	22.9 ± 4.9
Menarche (years)	12.0 ± 1.4
Parity	
0	131 (60.0%)
> 1	90 (40.0%)
Rhythm of menstrual period	
Regular	42 (19.0%)
Irregular	179 (81.0%)
Length of menstrual period (days)	5.4 ± 1.3
Ultrasound (US) findings	
Uterine fibroids alone	32 (14.5%)
Uterine fibroids + adenomyosis	9 (4.1%)
Uterine Fibroids + endometriosis	7 (3.2%)
Adenomyosis alone	29 (13.1%)
Adenomyosis + endometriosis	29 (13.1%)
Endometriosis alone	34 (15.4%)
Endometrial pathology	8 (3.6%)
Congenital uterine malformations	5 (2.3%)
Functional ovarian cysts	2 (0.9%)
Polycystic ovary	3 (1.3%)
Normal US findings	60 (27.1%)

In Table 3, comparisons between median scores of PBAC and MP among the different age groups were described.

We observed statistically significant differences in comparing median scores of the two pictograms between the age groups 12–20 and 41–55, both for PBAC (118, range 50.5–205.75 vs 190, range 65–278.5, $p < 0.003$) and MP (86.25, range 43.25–178.5 vs 131.5, range 55.5–189, $p < 0.003$); statistically significant differences were also seen comparing the age groups 31–40 and 41–55 both for PBAC (127, range 74.5–247 vs 90, range 65–278.5, $p < 0.008$) and MP (107, range 60.75–189.75 vs 131.5, range 55.5–189, $p < 0.008$). (Fig. 4).

Table 4 showed the comparison between self-perception and the use of pictograms according to the different TVS findings; we didn't observe statistically significant differences between self-perception and the pictograms and also between both pictograms, in describing normal and heavy menstrual bleeding according to the ultrasound findings. (Table 4) In patients with normal ultrasound findings, we observed less severe symptoms (dysmenorrhea, dyspareunia

Table 2 Chi-square test was performed to compare self-perception and pictograms (PBAC and MP) in case of normal and heavy menstrual bleeding in the total population study and according to different age groups

	Self-perception of MBL *Normal n* (%)	PBAC < 150 *n* (%)	MP < 80 *n* (%)	*p* value	Self-perception of MBL *Heavy* n (%)	PBAC ≥ 150 *n* (%)	MP ≥ 80 *n* (%)	*p* value
Tot = 221	111/221 (50.2)	124/221 (56.1)	91/221 (41.2)	[a]$p=0.2$ [b]$p=0.06$ [c]$p=0.001$	110/221 (49.8)	97/221 (43.9)	130/221 (58.8)	[d]$p=0.2$ [e]$p=0.06$ [f]$p=0.001$
Group Age 12–20 ($n=24$)	12/24 (50.0)	16/24 (66.7)	12/24 (50.0)	[a]$p=0.2$ [b]$p=1.0$ [c]$p=0.2$	12/24 (50.0)	8/24 (33.3)	12/24 (50.0)	[d]$p=0.2$ [e]$p=1.0$ [f]$p=0.2$
Group Age 21–30 ($n=53$)	19/53 (35.8)	23/53 (43.4)	19/53 (35.8)	[a]$p=0.4$ [b]$p=1.0$ [c]$p=0.4$	34/53 (64.2)	30/53 (56.6)	34/53 (64.2)	[d]$p=0.4$ [e]$p=1.0$ [f]$p=0.4$
Group Age 31–40 ($n=67$)	35/67 (52.2)	38/67 (56.7)	25/67 (37.3)	[a]$p=0.5$ [b]$p=0.08$ [c]$p=0.02$	32/67 (47.8)	29/67 (43.3)	42/67 (62.7)	[d]$p=0.6$ [e]$p=0.08$ [f]$p=0.02$
Group Age 41–55 ($n=77$)	45/77 (58.4)	47/77 (61.0)	35/77 (45.5)	[a]$p=0.7$ [b]$p=0.1$ [c]$p=0.05$	32/77 (41.6)	30/77 (39.0)	42/77 (54.5)	[d]$p=0.7$ [e]$p=0.1$ [f]$p=0.05$

A p value < 0.05 was considered statistically significant

MBL menstrual blood loss, *PBAC* pictorial blood loss assessment chart, *MP* menstrual pictogram

[a]Comparison between *normal* self-perception of MBL and PBAC < 150

[b]Comparison between *normal* self-perception of MBL and MP < 80

[c]Comparison between PBAC < 150 and MP < 80

[d]Comparison between *heavy* self-perception of MBL and PBAC ≥ 150

[e]Comparison between *heavy* self-perception of MBL and MP ≥ 80

[f]Comparison between PBAC ≥ 150 and MP ≥ 80

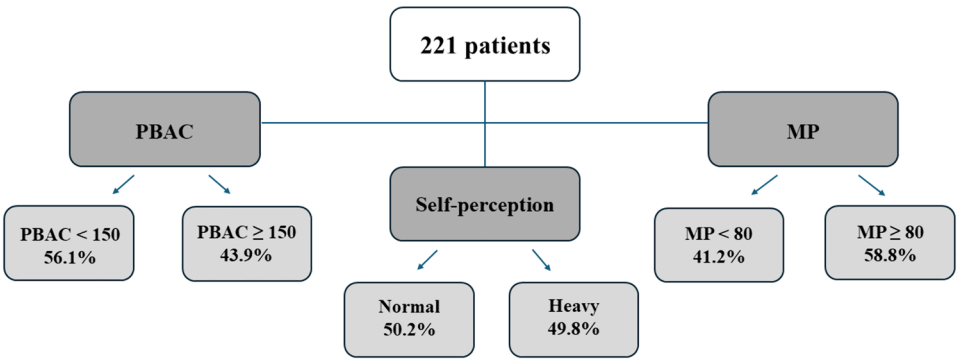

Fig. 3 Graphic representation of the percentage of patient's self-perception and of PBAC and MP results in the total population (n = 221). PBAC = Pictorial Blood Chart Assessment, MP = Menstrual Pictogram

and chronic pelvic pain) compared to those with pathological findings on ultrasound.

Discussion

This study demonstrated that self-perception alone could be a reliable method to assess the amount of MBL in patients of different age and also according to the different ultrasound findings.

The main objective was to evaluate the amount of MBL in a group of women with double evaluation: "self-perception" or with the use of "Pictograms" (PBAC/MP). The secondary aim was to correlate the assessment of MBL by self-perception and with the use of pictograms in patients with both normal ultrasound and pelvic gynecological pathologies.

Nowadays, the evaluation of MBL represents a hot topic in literature because of the variability of the studies in which self-perception or different pictograms have been used as the gold standard for the assessment of the problem. A correct

Table 3 Comparison between PBAC and MP median scores according to different age subgroups

	Group age 12–20 ($n=24$)	Group age 21–30 ($n=53$)	Group age 31–40 ($n=67$)	Group age 41–55 ($n=77$)	p value
PBAC *Median (IQR, 25th-75th)*	118 (50.5–205.75)[a]	173 (69–260)	127 (74.5–247)[c]	190 (65–278.5)[ac]	0.01
MP *Median (IQR, 25th-75th)*	86.25 (43.25–178.5)[b]	117.5 (58–215)	107 (60.75–189.75)[d]	131.5 (55.5–189)[bd]	0.01

Non-parametric continuous data are expressed as median and range and were analyzed using Kruskal–Wallis (K–W). Dunn's test was used for multiple comparisons among groups

IQR: (25th-75th): interquartile range

PBAC pictorial blood loss assessment chart. *MP* menstrual pictogram

[a]Comparison between Age Group 12–20 PBAC and Age Group 41–55 PBAC; $p<0.05$

[b]Comparison between Age Group 12–20 MP and Age Group 41–55 MP; $p<0.05$

[c]Comparison between Age Group 31–40 PBAC and Age Group 41–55 PBAC; $p<0.05$

[d]Comparison between Age Group 31–40 MP and Age Group 41–55 MP; $p<0.05$

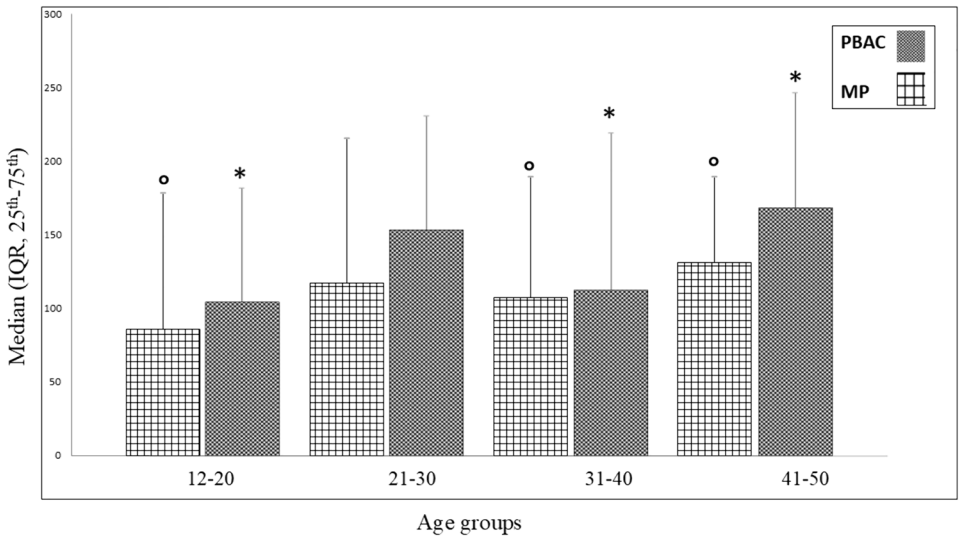

Fig. 4 Graphic illustration of the comparison between PBAC and MP median scores according to different age subgroups. PBAC = Pictorial Blood Loss Assessment Chart, MP = Menstrual Pictogram

evaluation of the MBL is crucial to improve the management of women with HMB and consequently their quality of life.

Interestingly, in our study population, only 13.6% of patients were referred for an ultrasound due to heavy menstruation. However, upon analyzing their self-perception, about 50% of them reported having HMB. This phenomenon is crucial in explaining how, in common clinical practice, patients may underestimate the actual amount of menstrual loss if not properly investigated.

PBAC and MP are semi-quantitative methods used to determine MBL volume utilizing icon-based visual scoring systems for commonly used sanitary products; several recent papers have studied the accuracy of these methods in evaluating MBL and good results have been achieved in terms of sensitivity and specificity [18].

However, these methods showed some limitations due to the large variety of commercially available sanitary products, and the consequent difficulties in fill them, that lead to a reduced accuracy [19].

In recent years, several papers have analyzed the reliability of self-perception in describing MBL, and the most representative result was that HMB is extensively underreported because of an inadequate self-perception and normalization of symptoms. [5, 6] In particular, Magnay et al. observed that self-perception is less accurate than pictograms in describing the amount of menstrual flow [6].

On the other hand, other papers highlighted the importance of self-perception and how it could be used to assess the amount of blood loss.

In 2003, Warner et al. showed that the volume of blood loss during the menstrual periods was significantly related to the patient's subjective judgment; in particular, those women who rated their periods as ''very heavy'' had a

Table 4 Chi-squared test was performed to compare self-perception and pictograms (PBAC and MP) in the study population according to ultrasound (US) findings

		Self-perception of MBL *Normal* *n* (%)	PBAC < 150 *n* (%)	MP < 80 *n* (%)	*p* value	Self-perception of MBL *Heavy* *n* (%)	PBAC ≥ 150 *n* (%)	MP ≥ 80 *n* (%)	*p* value
Normal US findings ($n=60$)		42/60 (70.0)	43/60 (71.6)	37/60 (61.6)	[a]$p=0.8$ [b]$p=0.3$ [c]$p=0.2$	18/60 (30.0)	17/60 (28.4)	23/60 (38.4)	[d]$p=0.8$ [e]$p=0.3$ [f]$p=0.2$
US pathological findings ($n=161$)	Uterine Fibroids ($n=32$)	20/32 (62.5)	22/32 (68.7)	19/32 (59.4)	[a]$p=0.6$ [b]$p=0.8$ [c]$p=0.4$	12/32 (37.5)	10/32 (31.3)	13/32 (40.6)	[d]$p=0.6$ [e]$p=0.8$ [f]$p=0.4$
	Uterine Fibroids + Adenomyosis ($n=9$)	4/9 (44.4)	3/9 (33.3)	1/9 (11.1)	[a]$p=0.6$ [b]$p=0.1$ [c]$p=0.3$	5/9 (55.6)	6/9 (66.7)	8/9 (88.9)	[d]$p=0.6$ [e]$p=0.1$ [f]$p=0.3$
	Uterine Fibroids + Endometriosis ($n=7$)	6/7 (85.7)	4/7 (57.1)	3/7 (42.9)	[a]$p=0.2$ [b]$p=0.1$ [c]$p=0.6$	1/7 (14.3)	3/7 (42.9)	4/7 (57.1)	[d]$p=0.2$ [e]$p=0.1$ [f]$p=0.6$
	Adenomyosis ($n=29$)	11/29 (37.9)	12/29 (41.4)	9/29 (31.0)	[a]$p=0.8$ [b]$p=0.6$ [c]$p=0.4$	18/29 (62.1)	16/29 (55.2)	20/29 (69.0)	[d]$p=0.6$ [e]$p=0.6$ [f]$p=0.3$
	Adenomyosis + Endometriosis ($n=29$)	10/29 (34.5)	13/29 (44.8)	8/29 (27.6)	[a]$p=0.4$ [b]$p=0.6$ [c]$p=0.2$	19/29 (65.5)	16/29 (55.2)	21/29 (72.4)	[d]$p=0.4$ [e]$p=0.6$ [f]$p=0.2$
	Endometriosis ($n=34$)	11/34 (32.4)	16/34 (47.1)	9/34 (26.5)	[a]$p=0.2$ [b]$p=0.4$ [c]$p=0.08$	23/34 (67.6)	18/34 (52.9)	25/34 (73.5)	[d]$p=0.2$ [e]$p=0.4$ [f]$p=0.08$
	Endometrial pathology ($n=8$)	5/8 (62.5)	6/8 (75.0)	5/8 (62.5)	[a]$p=0.6$ [b]$p=1.0$ [c]$p=0.6$	3/8 (37.5)	2/8 (25.0)	3/8 (37.5)	[d]$p=0.6$ [e]$p=1.0$ [f]$p=0.6$
	Congenital uterine malformations ($n=5$)	2/5 (40.0)	3/5 (60.0)	2/5 (40.0)	[a]$p=0.5$ [b]$p=1.0$ [c]$p=0.5$	3/5 (60.0)	2/5 (40.0)	3/5 (60.0)	[d]$p=0.5$ [e]$p=1.0$ [f]$p=0.5$
	Functional cysts ($n=4$)	2/4 (50%)	2/4 (50%)	2/4 (50%)	[a]$p=1.0$ [b]$p=1.0$ [c]$p=1.0$	2/4 (50%)	2/4 (50%)	2/4 (50%)	[d]$p=1.0$ [e]$p=1.0$ [f]$p=1.0$
	Polycystic ovary ($n=3$)	1/3 (33.3%)	1/3 (33.3%)	1/3 (33.3%)	[a]$p=1.0$ [b]$p=1.0$ [c]$p=1.0$	2/3 (66.6%)	2/3 (66.6%)	2/3 (66.6%)	[d]$p=1.0$ [e]$p=1.0$ [f]$p=1.0$

MBL menstrual blood loss, *PBAC* pictorial blood loss assessment chart, *MP* menstrual pictogram, *Endo* endometriosis

[a]Comparison between normal self-perception of MBL and PBAC < 150

[b]Comparison between normal self-perception of MBL and MP < 80

[c]Comparison between PBAC < 150 and MP < 80

[d]Comparison between heavy self-perception of MBL and PBAC ≥ 150

[e]Comparison between heavy self-perception of MBL and MP ≥ 80

[f]Comparison between PBAC ≥ 150 and MP ≥ 80

mean blood loss that was 61% higher than the remainder of the women [10].

A recent paper of 2021, by KI Ko et al., demonstrated good associations of self-perceived symptoms with PBAC score and hemoglobin level in a group of Asian women; in particular, women with HMB had significantly higher total PBAC scores compared with women who had normal menstrual flow [11].

In our study, no differences were found between the self-perceived MBL and the use of PBAC and MP among the whole cohort both regarding normal and heavy menstrual bleeding; this result was also confirmed by dividing patients in different age groups, from the adolescence to the perimenopause.

While in comparing the use two pictograms PBAC and MP in the total population and in the different age groups, significant differences were observed, in particular among patients between 31 and 40 years old.

This is crucial to understand that both adolescents and women in pre- or perimenopause are able to describe their symptoms, if correctly evaluated.

Furthermore, since statistically significant discrepancies have emerged in our population from the use of the two pictograms and since neither of the two has been considered superior to the other in the literature, we can assess that self-perception alone could be the only method to evaluate MBL.

In this setting, the clinician plays an important role; an accurate investigation of the symptoms is fundamental to have a precise self-evaluation of MBL.

By evaluating the mean scores of PBAC and MP among the different age groups, we observed that younger patients tend to have lower scores compared to older ones, as demonstrated by the differences found between the groups of patients between 12–20 years and 31–40 and the group of patients between 41 and 55 years. This result is in line with Barr et al., who developed in 1999 a different pictorial chart to evaluate the amount of blood loss in a cohort of Nigerian adolescents; [20] in this paper, adolescents had a lower cut-off value for HMB (PBAC score > 50) compared to adults. However, this method resulted to have a low sensitivity and specificity and it was only used once in the literature [21].

Other papers in literature found that the mean PBAC score increased with age and days of bleeding [22, 23].

Moreover, by analyzing patients according to the ultrasound findings, we found that both groups of patients with normal or pathological pelvic findings didn't show differences regarding the MBL assessment using self-perception or pictograms. This is important in evaluating patients with common pelvic pathologies, such as adenomyosis and fibroids, thus, to consider self-perception also in these cases.

Our study has some limitations; first, the population age groups are inhomogeneous: a higher adolescent's sample size is needed to draw more robust conclusions on the analyzed endpoints. Additionally, we lacked an objective method to quantify menstrual bleeding, such as weighing sanitary pads as done by Magnay et al. [9] Future studies are needed to develop objective methods to validate our findings.

Moreover, we did not focus on other menstrual-related symptoms, such as dysmenorrhea and abdominal pain, which patients—particularly adolescents—may underestimate. [24] These symptoms can impair cognitive function and alter the perception of menstrual bleeding, as recently demonstrated by Kluska et al. [25].

Conclusions

In conclusion, our study demonstrated that self-perception alone could be a reliable method to describe MBL, showing no differences compared to the use of semi-quantitative pictograms. Women at different age can describe the amount of their blood flow, both in case of normal or pathological TVS findings. Since the use of pictograms could be confusing and sometimes difficult for patients to understand, and self-perception has proven to be accurate in evaluating the amount of menstrual flow, the role of the clinician is pivotal to carefully investigate patient's symptoms.

In the era of artificial intelligence (AI), future methods for assessing menstrual bleeding through dedicated software and apps could significantly aid in managing numerous gynecological conditions, such as menstrual disorders, especially in adolescent populations [26]. Further studies, including more homogeneous groups, are needed to confirm our data.

Author contributions Russo: Manuscript Writing and editing, Palumbo: Manuscript Writing, Reppuccia: Data collection, Iorio: Statistical analysis, Nocita: Data collection, Monaco: Data collection, Iacobini: Data collection, Soreca: Data collection, Exacoustos: Project development, Manuscript Writing and editing.

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Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

References

1. Pai M, Chan A, Barr R (2013) How I manage heavy menstrual bleeding. Br J Haematol 162(6):721–729. https://doi.org/10.1111/bjh.12447
2. Munro MG, Critchley HO, Broder MS, Fraser IS, FIGO Working Group on Menstrual Disorders (2011) FIGO classification system (PALM-COEIN) for causes of abnormal uterine bleeding in nongravid women of reproductive age. Int J Gynaecol Obstet 113(1):3–13. https://doi.org/10.1016/j.ijgo.2010.11.011
3. Munro MG, Critchley HOD, Fraser IS, FIGO Menstrual Disorders Committee (2018) The two FIGO systems for normal and abnormal uterine bleeding symptoms and classification of causes of abnormal uterine bleeding in the reproductive years: 2018 revisions. Int J Gynaecol Obstet 143(3):393–408. https://doi.org/10.1002/ijgo.12666
4. Hallberg L, Högdahl AM, Nilsson L, Rybo G (1966) Menstrual blood loss—a population study. Variation at different ages

and attempts to define normality. Acta Obstet Gynecol Scand 45(3):320–351. https://doi.org/10.3109/00016346609158455
5. Fraser IS, Mansour D, Breymann C, Hoffman C, Mezzacasa A, Petraglia F (2015) Prevalence of heavy menstrual bleeding and experiences of affected women in a European patient survey. Int J Gynaecol Obstet 128(3):196–200. https://doi.org/10.1016/j.ijgo.2014.09.027
6. Magnay JL, O'Brien S, Gerlinger C, Seitz C (2018) A systematic review of methods to measure menstrual blood loss. BMC Womens Health 18(1):142. https://doi.org/10.1186/s12905-018-0627-8
7. Higham JM, O'Brien PM, Shaw RW (1990) Assessment of menstrual blood loss using a pictorial chart. Br J Obstet Gynaecol 97(8):734–739. https://doi.org/10.1111/j.1471-0528.1990.tb16249.x
8. Wyatt KM, Dimmock PW, Walker TJ, O'Brien PS (2001) Determination of total menstrual blood loss. Fertil Steril 76(1):125–131. https://doi.org/10.1016/s0015-0282(01)01847-7
9. Magnay JL, Nevatte TM, O'Brien S, Gerlinger C, Seitz C (2014) Validation of a new menstrual pictogram (superabsorbent polymer-c version) for use with ultraslim towels that contain superabsorbent polymers. Fertil Steril 101(2):515–522. https://doi.org/10.1016/j.fertnstert.2013.10.051
10. Warner PE, Critchley HO, Lumsden MA, Campbell-Brown M, Douglas A, Murray GD (2004) Menorrhagia I: measured blood loss, clinical features, and outcome in women with heavy periods: a survey with follow-up data. Am J Obstet Gynecol 190(5):1216–1223. https://doi.org/10.1016/j.ajog.2003.11.015
11. Ko JKY, Lao TT, Cheung VYT (2021) Pictorial blood loss assessment chart for evaluating heavy menstrual bleeding in Asian women. Hong Kong Med J 27(6):399–404. https://doi.org/10.12809/hkmj208743
12. Vannuccini S, Jain V, Critchley H, Petraglia F (2022) From menarche to menopause, heavy menstrual bleeding is the underrated compass in reproductive health. Fertil Steril 118(4):625–636. https://doi.org/10.1016/j.fertnstert.2022.07.021
13. Van den Bosch T, Dueholm M, Leone FP, Valentin L, Rasmussen CK, Votino A, Van Schoubroeck D, Landolfo C, Installé AJ, Guerriero S, Exacoustos C, Gordts S, Benacerraf B, D'Hooghe T, De Moor B, Brölmann H, Goldstein S, Epstein E, Bourne T, Timmerman D (2015) Terms, definitions and measurements to describe sonographic features of myometrium and uterine masses: a consensus opinion from the Morphological Uterus Sonographic Assessment (MUSA) group. Ultrasound Obstet Gynecol 46(3):284–298. https://doi.org/10.1002/uog.14806
14. Harmsen MJ, Van den Bosch T, de Leeuw RA, Dueholm M, Exacoustos C, Valentin L, Hehenkamp WJK, Groenman F, De Bruyn C, Rasmussen C, Lazzeri L, Jokubkiene L, Jurkovic D, Naftalin J, Tellum T, Bourne T, Timmerman D, Huirne JAF (2022) Consensus on revised definitions of morphological uterus sonographic assessment (MUSA) features of adenomyosis: results of modified Delphi procedure. Ultrasound Obstet Gynecol 60(1):118–131. https://doi.org/10.1002/uog.24786
15. Leone FP, Timmerman D, Bourne T, Valentin L, Epstein E, Goldstein SR, Marret H, Parsons AK, Gull B, Istre O, Sepulveda W, Ferrazzi E, Van den Bosch T (2010) Terms, definitions and measurements to describe the sonographic features of the endometrium and intrauterine lesions: a consensus opinion from the International Endometrial Tumor Analysis (IETA) group. Ultrasound Obstet Gynecol 35(1):103–112. https://doi.org/10.1002/uog.7487
16. Timmerman D, Valentin L, Bourne TH, Collins WP, Verrelst H, Vergote I, International Ovarian Tumor Analysis (IOTA) Group (2000) Terms, definitions and measurements to describe the sonographic features of adnexal tumors: a consensus opinion from the International Ovarian Tumor Analysis (IOTA) Group. Ultrasound Obstet Gynecol 16(5):500–505. https://doi.org/10.1046/j.1469-0705.2000.00287.x
17. Guerriero S, Condous G, van den Bosch T, Valentin L, Leone FP, Van Schoubroeck D, Exacoustos C, Installé AJ, Martins WP, Abrao MS, Hudelist G, Bazot M, Alcazar JL, Gonçalves MO, Pascual MA, Ajossa S, Savelli L, Dunham R, Reid S, Menakaya U, Bourne T, Ferrero S, Leon M, Bignardi T, Holland T, Jurkovic D, Benacerraf B, Osuga Y, Somigliana E, Timmerman D (2016) Systematic approach to sonographic evaluation of the pelvis in women with suspected endometriosis, including terms, definitions and measurements: a consensus opinion from the International Deep Endometriosis Analysis (IDEA) group. Ultrasound Obstet Gynecol 48(3):318–332. https://doi.org/10.1002/uog.15955
18. Magnay JL, Nevatte TM, Seitz C, O'Brien S (2013) A new menstrual pictogram for use with feminine products that contain superabsorbent polymers. Fertil Steril 100(6):1715-1721.e4. https://doi.org/10.1016/j.fertnstert.2013.08.028
19. El-Nashar SA, Shazly SAM, Famuyide AO (2015) Pictorial blood loss assessment chart for quantification of menstrual blood loss: a systematic review. Gynecol Surg 12:157–163. https://doi.org/10.1007/s10397-015-0893-5
20. Barr F, Brabin L, Agbaje O (1999) A pictorial chart for managing common menstrual disorders in Nigerian adolescents. Int J Gynaecol Obstet 66(1):51–53. https://doi.org/10.1016/s0020-7292(99)00025-9
21. Özcan H, Burger NB, Dulmen-den Broeder EV, van Baal MW, den Boogaard EV, De Leeuw RA, Huirne JAF (2024) Instruments to identify menstrual complaints and their impact on adolescents: a systematic review. J Pediatr Adolesc Gynecol 37(2):106–120. https://doi.org/10.1016/j.jpag.2023.11.011
22. Barcelos RS (2013) Menstrual disorders among women 15 to 54 years of age in Pelotas, Rio Grande do Sul State, Brazil: a population-based study. Cad Saude Publica 29(11):2333–2346. https://doi.org/10.1590/0102-311x00002813
23. Toxqui L, Pérez-Granados AM, Blanco-Rojo R, Wright I, Vaquero MP (2014) A simple and feasible questionnaire to estimate menstrual blood loss: relationship with hematological and gynecological parameters in young women. BMC Womens Health 30(14):71. https://doi.org/10.1186/1472-6874-14-71
24. Martire FG, Piccione E, Exacoustos C, Zupi E (2023) Endometriosis and adolescence: the impact of dysmenorrhea. J Clin Med 12(17):5624. https://doi.org/10.3390/jcm12175624
25. Kluska J, Malinowska E, Kowalski J (2024) A pilot longitudinal study of decrease in cognitive functions during the most painful day of the period among women with primary dysmenorrhea. Arch Gynecol Obstet. https://doi.org/10.1007/s00404-024-07617-9
26. Khan I, Khare BK (2024) Exploring the potential of machine learning in gynecological care: a review. Arch Gynecol Obstet 309(6):2347–2365. https://doi.org/10.1007/s00404-024-07479-1