Review

Hysteroscopic removal of polyps and fibroids in the outpatient setting*

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Abstract

Technological advances have facilitated the removal of endometrial polyps and submucous fibroids in an outpatient setting. This narrative review summarises the role, technologies and techniques, feasibility and effectiveness relating to outpatient hysteroscopic removal of uterine polyps and fibroids. A systematic electronic literature search of PubMed, Europe PMC, and Google Scholar in July 2023 was performed. The main outcome measures described were indications, patient selection and counselling, control of pain, modern definitions of treatment setting, available technologies, appropriate techniques and the evidence-base and future research directions. The results show that attention to patient counselling and the use of miniature instruments allowing vaginoscopy, and the judicious use of local anaesthesia with good technique are associated with improved patient experience and complete excision of uterine polyps and fibroids. Outpatient polypectomy is safe, feasible, acceptable, effective and cost-effective. Mechanical hysteroscopic tissue removal systems (mHTR) should be preferred to conventional mechanical instruments and electrosurgery because they are quicker, less painful, more acceptable and more successful. Outpatient hysteroscopic myomectomy is feasible using electrosurgery and mHTRs but appears more successful with smaller, more accessible fibroids. More research is needed surrounding case selection, identification of the best technologies and techniques and clinical effectiveness for hysteroscopic myomectomy in the outpatient setting.

Keywords: **Endometrial polyp, fibroid, myoma, hysteroscopy, outpatient, office, tissue removal system, electrosurgery.**

Introduction

Endometrial polyps and submucous fibroids are the most commonly encountered intrauterine pathologies encountered at hysteroscopy. Endometrial polyps are localised overgrowths of endometrial tissue that can occur anywhere in the uterine cavity. They contain variable amounts of glands, stroma and blood vessels that are covered by a layer of endometrium. Endometrial polyps vary in prevalence with a reported range between 20% - 40% and occur in women of reproductive and post-reproductive age (Lasmar et al., 2008; Nagele et al., 1996; Clevenger et al., 1999; van Dongen et al., 2007; Coloma et al., 1998). Uterine fibroids or leiomyomas ("myomas") on the other hand are solid, invariably benign tumours of uterine smooth muscle and connective tissue. Fibroids that encroach beyond the myometrium into the uterine cavity are called submucous or submucosal or intra-cavity fibroids and may account for up to 10% of all fibroids (Coloma et al., 1998).

Whilst these focal pathologies may be associated with reproductive failure (subfertility and miscarriage) (ARSM., 2008; Russo et al., 2016), the most frequently reported associated symptom is abnormal uterine bleeding (AUB); heavy menstrual bleeding (HMB), intermenstrual bleeding (IMB) and postmenopausal bleeding (PMB) with or without the use of hormone replacement therapy (HRT) (Lasmar et al., 2008; Lieng et al., 2009; Clark and Connor, 2020; Emmanuel et al., 1995).

Thus, hysteroscopic surgical removal can help improve fertility and alleviate AUB symptoms. In addition, obtaining a tissue sample for analysis can help diagnose premalignant and malignant pathology. The potential for (pre) malignancy inside endometrial polyps is reported to be up to 12% in patients with predisposing factors such as menopause, age over 60, diabetes, obesity, or the use of tamoxifen (van Dongen et al., 2007; Sasaki et al., 2018), and such oncogenic change is thought be even lower in submucous fibroids (Baranov et al., 2019). However, the current guidelines state that although hysteroscopic morcellation occurs in the uterus compared to laparoscopic morcellation which occurs in the abdomen, it still carries a theoretical risk of disseminating occult malignant tissues through retrograde flow via the fallopian tubes or perforation. Similar to intraperitoneal morcellation, hyseroscopic morcellation should be avoided if malignancy was suspected, however, it remains an appropriate method of managing submucosal fibroid in symptomatic women (NICE, 2021; ESGE, 2014; AAGL, 2014; ACOG, 2014).

Hysteroscopy is considered the gold standard technique for the diagnosis and treatment of endometrial polyps (Russo et al., 2016; Coloma et al 1998; RCOG GTG 59, 2020; ACOG, 2020; Cooper et al., 2015), and submucous fibroids (Farquhar et al., 2003; van Dongen et al., 2007; NICE, 2021; AAGL, 2012; Loddo et al., 2022). Conventional practice is to undertake these procedures under general anaesthesia in a hospital operating theatre. However, with advances in endoscopic technology, especially imaging quality, miniaturisation / portability of endoscopes and novel ancillary instrumentation, it is now possible to perform hysteroscopic polypectomy and myomectomy in an outpatient setting without the need for hospital admission and general or regional anaesthesia or deep intravenous sedation (Clark and Gupta, 2005; Clark and O'Donovan, 2015; Clark and Connor, 2020). Whilst treatment in this setting is convenient, the limitations of operating in the genital tract using miniature equipment in a conscious patient may offset any apparent benefits.

This paper will review the hysteroscopic treatment of endometrial polyps and submucous fibroids in a contemporary outpatient setting. Modern terminology defining treatment setting will be presented along with indications, patient selection, patient counselling and pain control. Moreover, the available technologies and surgical techniques will be evaluated with a focus on practical approaches, and optimising feasibility and clinical outcomes, namely effectiveness in alleviating clinical symptoms, safety and patient experience. Finally, quality assurance and future research opportunities will be discussed.

Search strategy and identification of studies

Our review covers several relevant aspects pertaining to the hysteroscopic removal of polyps and fibroids in an outpatient setting. Important terminology relating to the definitions of procedural setting is discussed using the recent joint consensus document from the European Society of Gynecological Endoscopy (ESGE), the Global Congress of Hysteroscopy (GCH) and the American Association of Gynecologic Laparoscopy (AAGL) (Carugno et al., 2021; Carugno et al., 2022). One of the authors (TJC) is an author on an extensively revised, updated version of the joint Royal College of Obstetricians and Gynaecologists (RCOG) and British Society for Gynaecological Endoscopy (BSGE) document, which is currently under peer review (Clark and Connor, 2020). This evidence-based guideline comprehensively covers pain control measures in the outpatient setting for diagnostic and operative hysteroscopy and we have used these collated data to inform this narrative review with a focus on removing polyps and fibroids. The guidance along with an RCOG Good Practice Paper (GPP) in outpatient hysteroscopy covers patient selection and counselling and this has been our main source to cover these aspects of care (RCOG GPP, 2023).

As regards identification of the available methods for removing polyps and fibroids and their feasibility and efficacy in an outpatient setting, we used relevant data from the aforementioned extensively revised and updated RCOG/BSGE outpatient hysteroscopy guidance. In addition, we conducted electronic searches between Oct 1990 and June 2023 of the PubMed database, Europe PMC, the Cochrane Central Register of Controlled Trials (CENTRAL) and Google Scholar. Potentially relevant studies were identified using a combination of the keywords "hysteroscopy*", "outpatient", "ambulatory", "office" and their associated medical subject headings (MeSH). In order to capture as many studies as possible, restrictions were not placed on the search and the reference lists of all included papers were reviewed and further studies were included if considered relevant. Our inclusion criteria were any systematic reviews, randomised controlled studies, prospective and retrospective cohort studies that provided data on the feasibility and / or clinical outcomes of hysteroscopic polypectomy and / or myomectomy. Initially, all the potentially eligible papers were independently evaluated by reading the title and abstract. When it was not possible to assess the eligibility of the

article by only reading title and abstract, the authors read the full text.

Definitions and classifications

Endometrial polyps

Endometrial polyps are focal endometrial outgrowths that can occur anywhere within the uterine cavity. They contain a variable amount of glands, stroma and blood vessels, the relative amounts of which influence their visual appearance at hysteroscopy. Polyps may be soft and cystic or firm and fibrous; they may be pedunculated or sessile, single or multiple, and vary in size from small (a few millimetres with minimal uterine cavity distortion), to large (several centimetres), filling the whole cavity.

There are no standard classification systems for endometrial polyps based upon hysteroscopy, although one of the authors (TJC) is leading on such a system on behalf of the International Federation of Gynecology and Obstetrics FIGO) to help predict the feasibility of removal and the nature of endometrial polyps. Hysteroscopic identification of polyps and submucosal fibroids (myomas) is generally easy. Figure 1 provides useful clinical (hysteroscopic) definitions of these two focal lesions (Clark and Gupta, 2005; Cooper et al., 2015). However, where endometrial polyps contain much fibrous stromal tissue then differentiation between the two common types of acquired focal pathology may only be definitively determined by histological examination. Submucous fibroids may be difficult to delineate from adenomyomas and smooth muscle tumours of uncertain malignant potential (STUMP). Folds of secretory endometrium may be mistaken for sessile endometrial polyps.

Submucous fibroids

Uterine fibroids or leiomyomas or 'myomas', are smooth muscle tumours and are the commonest benign tumours in females. They originate within the myometrium and can expand to deviate the mucosal layer (submucous) so that they are visible within the uterine cavity. These solid tumours are well demarcated by a pseudocapsule and their growth is dependent upon stimulation by oestrogen. They are usually solitary but can be multiple and vary in size.

There are two classification systems for fibroids, one adopted by the International Federation of Gynaecology and Obstetrics (FIGO), and one by the European Society of Gynaecological Endoscopy (ESGE). Both FIGO and ESGE (Munro et al., 2011; Wamsteker et al., 1993) classification of uterine fibroids are shown in (Table I).

The "STEPW or Lasmar" hysteroscopic myoma classification was developed in 2005 (Lasmar et al., 2012). It evaluates five parameters which allows better planning and preparation for surgery (Table II). The STEPW classification identifies the group of submucous fibroids in which incomplete myomectomy will be the outcome and the group in which complete removal will occur based on scores (Table II). This allows the surgeon to provide better counselling prior to consenting the patient for the procedure. Whilst the Lasmar classification does not specifically address the feasibility of hysteroscopic myomectomy in an outpatient setting, it is intuitive that Group 1 (low complexity) procedures should be

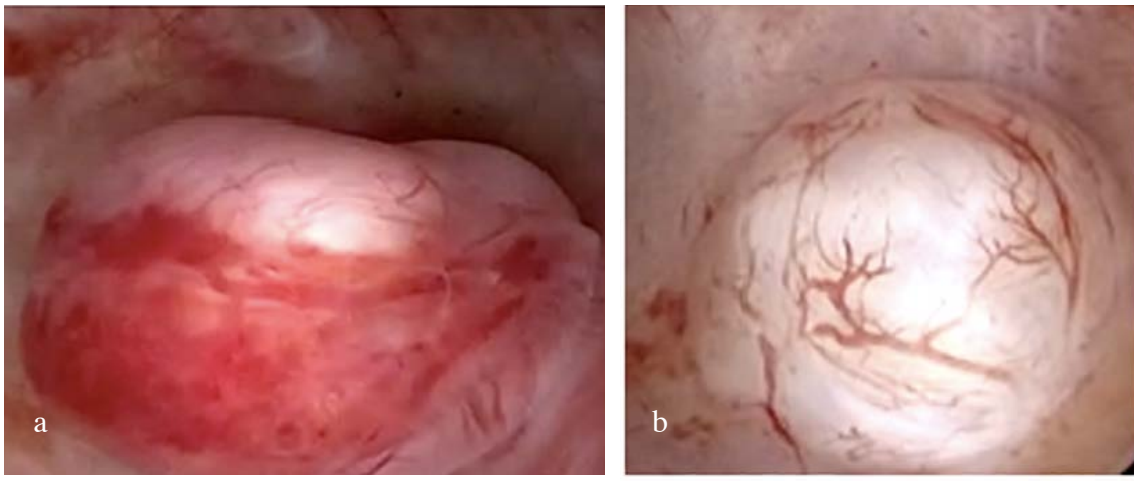

Figure 1: (a) Hysteroscogic definitions of endometrial polyps and submucous fibroids (Clark and Gupta, 2005). Endometrial polyp: a discrete outgrowth of endometrium, attached by a pedicle, which moves with the flow of the distension medium. Polyps may be pedunculated or sessile, single or multiple and vary in size (the variable amount of glands, stroma and blood vessels that constitute the polyp will influence their macroscopie appearance [i.e. glandulocystic polyps or firmer, more fibrous polyps (indistinguishable in some instances from grade 0 submucous fibroids)]. (b) Submucous fibroid: a firm, smooth and irregular sessile or pedunculated, intracavitx formation, covered by a thin, pale and transparent layer of endometrium revealing superficially large blood vessels, distorting the regular contour of an otherwise normal endometrial cavity.

Table I. — FIGO and ESGE classification of uterine fibroids.

ESGE	Fibroid type	FIGO	Fibroid type	Location
No myometrial involvement – pedunculated	0	Submucosal	0	Pedunculated in the cavity
<50% myometrial involvement	1		1	<50% intramural
			2	≥50% intramural
		Intramural	3	Contacts endometrium, 100% intramural
			4	100% Intramural
		Subserosal	5	Subserous and ≥50% intramural
≥ 50%myometrial involvement	2		6	Subserous and <50% intramural
		Pendunculated	7	Subserous pedunculated
		Other	8	Cervical/parasitic
		Hybrid leiomyoma	2-5	Submucous and subserous, each with less than half the diameter in the endometrial and peritoneal cavities

selected as prolonged procedures are less likely to be achievable or tolerated by the patient.

Standardising terminology for procedural setting

Pain associated with such hysteroscopic procedures limits their feasibility and can adversely affect patient experience (Mahmud et al., 2021; Clark and O'Donovan, 2015). Thus, pain management during operative hysteroscopy is of fundamental importance. However, reporting of the treatment setting and pain control measures lacks consistency. This non-uniformity of reporting limits the interpretation of research and generalisability of findings to individual practice, which in turn can impede the production of evidence-based guidance.

To try and provide consistency in reporting of hysteroscopic interventions, an international group of expert hysteroscopists was convened to produce a consensus statement for recommended terminology describing hysteroscopic procedures (Carugno el al., 2021; Carugno et al., 2022). A key component of this consensus was describing the treatment setting; it was decided that this should be defined according to the type of facility where the hysteroscopy was undertaken in conjunction with the highest level of pain control used.

To this end, a consensus was reached about a hierarchy of pain control measures relevant to hysteroscopy (Carugno el al., 2021; Carugno et al., 2022):

1. No medication or the use of oral non-sedative medication
2. Local anaesthetic to the genital tract
3. Conscious sedation
    a. Oral or inhalational medications with a sedative effect
    b. Parenteral medications with a sedative effect
4. Regional anaesthesia
5. General anaesthesia

Table II. — STEPW classification of uterine fibroids.

	Size (cm)	Topography	Extension of the base	Penetration	Lateral wall	Total
0	< 2	Low	< 1/3	0	+1	
1	2 to 5	Middle	1/3 to 2/3	<50%		
2	> 5	Upper	>2/3	>50%		

Score	Group	Complexity and therapeutic options
0 to 4	I	Less complexity hysteroscopic myomectomy
5 to 6	II	High complexity hysteroscopic myomectomy Consider GnRHa use Consider two steps hysteroscopic myomectomy
7 to 9	III	Consider alternatives to the hysteroscopic techniques

Moreover, it was agreed that the type of facility (office, outpatient clinic, community clinic, surgical centre, hospital) should be defined in alignment with the "International Association for Ambulatory (Day) Surgery (IAAS) Suggested International Terminology and Definitions" (Castoro et al., 2006). To provide greater clarity, the group agreed that the length of stay and plan for admission to a specific health care facility should not be used to inform the definition of treatment setting, but rather should be kept distinct and reported within a separate "model of care" category comprising the following: office, outpatient, ambulatory, extended recovery, inpatient.

In summary, treatment settings are defined thus (Carugno el al., 2021; Carugno et al., 2022): In summary, treatment settings are defined thus (Carugno el al., 2021; Carugno et al., 2022):

Office setting

- The hysteroscopic procedure is performed in a medical practitioner's professional premises where pain control up to level 3(a) can be administered.

Outpatient clinic setting

- The hysteroscopic procedure is performed in a health care facility for the management of outpatients e.g. hospital, community clinic or a freestanding surgical centre where pain control up to level 3(a) can be administered.

Operating Room setting

- The hysteroscopic procedure is performed in a fully equipped operating theatre where pain control up to level 5 can be administered

In exceptional circumstances, it was agreed that the treatment setting could be described as 'office' or 'outpatient' where pain management up to level 3(b) is administered. This was allowed to recognise the fact that local legislation permits the use of such pain control measure in some countries in an office / outpatient facility. However, it was emphasised that if the setting is defined as an office or outpatient clinic then it should be reported that level 3(b) pain management was used with details of type of pain management administered and route of administration.

It is hoped that this standardised nomenclature is adopted by the gynaecological community and that research papers and conference submissions relating to hysteroscopic surgery define the treatment setting in compliance with the international consensus statement (Carugno el al., 2021; Carugno et al., 2022): In addition, these clinical and academic documents and presentations should describe the pain control measures used in accordance with the agreed pain control hierarchy used and the model of care (defined according to need for admission / planned length of stay and type of facility).

Pain control

Outpatient or office hysteroscopic polypectomy or myomectomy relates to procedures in a setting where pain control up to level 3a (i.e. oral and / or inhalational analgesics / sedatives with or without local genital tract anaesthesia) (Carugno et al., 2021; Carugno et al., 2022). It is of paramount importance to manage pain to make operative hysteroscopy as painless as possible for the patient, enhance their experience and reduce the likelihood of a failed hysteroscopy due to unacceptable discomfort.

The joint British Society for Gynaecological Endoscopy (BSGE) and Royal College of Obstetricians and Gynaecologists (RCOG) evidence-based "Green Top Guideline 59" on "Best Practice in Outpatient Hysteroscopy" identified good technique, especially the use of miniature hysteroscopes, a vaginoscopic approach and minimising distension pressures, as of key importance (RCOG, 2022). Although not covered by this guidance, when operating on or within the myometrium the operator needs to be aware that sensory innervation inside the uterine cavity is mainly found in the myometrium (Tommaso et al., 2016). It is therefore important technically if removing polyps to be precise and avoid unnecessary painful trauma to the underlying myometrium. Similarly, when removing fibroids precision is necessary to ensure cutting and manipulation of the intracavitary fibrous tissue, which are not reached by nerve fibres, rather than adjacent myometrium to minimise pain.

In addition, the BSGE / RCOG evidence-based guidance recommended the use of pre-procedural, simple oral analgesics. This recommendation was based upon a metanalysis of 22 randomised control trials that analysed the effects of analgesia on pain both during and after hysteroscopy compared with a placebo (De Silva et al., 2020; Souza et al., 2020; De Silva et al., 2021; De Angelics et al., 2003; Lisón et al., 2017; Clark et al., 2002). Oral NSAIDs such as ibuprofen were proven effective in reducing pain intra-procedure and post-procedure when taken one hour prior to hysteroscopy. Moreover, no increase in adverse events was reported. Therefore, oral NSAIDs are an effective, low-risk option for reducing pain in an outpatient hysteroscopy setting and in the absence of contraindications should be taken pre-operatively. Paracetamol can be utilised for pain-relief since it is safe and well tolerated,

however, evidence regarding its efficacy in reducing pain in an outpatient hysteroscopy setting is limited.

Inhaled nitrous oxide gas is another form of analgesia which has been demonstrated to be more effective than a control in reducing pain associated with hysteroscopy although 5% of women did report dizziness with nitrous oxide (De Silva et al., 2021). Inhaled methoxyflurane (Penthrox®) is being trialled in our Unit because it has been shown to be effective in both emergency (Smith et al., 2022) and also elective (Hayne et al., 2021) settings, although data relating to gynaecological interventions are lacking (Stewart et al., 2023).

Local anaesthesia can be applied on, in, adjacent or through the cervix (RCOG, 2020). As such approaches cannot provide effective anaesthesia to the uterine body, the use of local anaesthesia is restricted to cases where cervical manipulation or dilation is required. There are a range of anaesthetic agents that can be delivered through various routes of administration, all of which have been shown to confer pain relief in the outpatient hysteroscopy setting (Clark and Gupta, 2005). Mepivacaine and bupivacaine have been reported to reduce pain both during and after hysteroscopy. Other agents including lidocaine and prilocaine significantly reduced pain during the hysteroscopy procedure. There has been recent interest in administration of local anaesthesia into the intrauterine fundus / cornua. This requires the hysteroscopic administration of local anaesthetic using a 5Fr needle and has been demonstrated to significantly decrease pain in a randomised control trial of outpatient endometrial ablation (Reinders et al., 2020). More RCTs are needed to see if this route of administration has effectiveness for outpatient hysteroscopic polypectomy and myomectomy.

Oral or vaginal prostaglandins can be considered to aid cervical dilatation and for pain control in addition to local anaesthesia. Prostaglandins have been shown to reduce pain, particularly when administered 12 hours prior to the procedure (Abdelhakim et al., 2019). However, prostaglandins are associated with side effects including genital tract bleeding, abdominal pain and gastrointestinal side effects which may lead to failure to complete the hysteroscopy (Abdelhakim et al., 2019).

Patient counselling

For any outpatient hysteroscopy procedure, it is important to adequately inform and counsel patients. The Royal College of Obstetricians and Gynaecologists (RCOG) have recently published a Good Practice Paper for outpatient hysteroscopy that includes practical approaches to patient counselling and consent (RCOG, 2023).

Women should ideally have been sent written information and / or access to online resources prior to attending. The local information provided should include any recommendations relating to taking simple analgesics prior to the appointment. The information provided should cover 'see and treat' if this approach is offered (i.e. polypectomy or myomectomy may be performed immediately following hysteroscopic diagnosis). Women should understand the rationale for removing polyps and fibroids and what to expect and the likely clinical outcomes. These include the likelihood of a failed or second stage procedure, and possible adverse effects and complications

The clinician should explore and address any concerns the patient might have about the procedure, especially regarding questions about pain management. The hysteroscopist must be reassured that the woman has had sufficient information to give informed verbal and/or written consent. The woman should be made aware of other settings and modes of anaesthesia for hysteroscopy as well as alternative care options available to her, and on the day of the procedure be given enough time to discuss any concerns or to change options. Importantly, the hysteroscopist must remind the woman that she is likely to experience period-like cramping and lower abdominal pain during and after the procedure and that should she find the procedure too painful or distressing she should notify her clinical team who will stop the procedure immediately.

Equipment

Hysteroscopes and fluid management

The development of small diameter hysteroscopic systems with outer diameters of 5.5mm or less, have driven the development of outpatient hysteroscopy because painful dilatation of the cervix can be avoided. Small diameter hysteroscopes with an integral working channel, typically 5Fr (1.8mm) or 7Fr (2.1mm) in diameter, allow for operative procedures to be performed in the outpatient setting (Bettochi et al., 2004; Vasiljević et al., 2019). Rigid reusable, rod lens systems (Figure 2a) and semi-rigid fibreoptic systems with a disposable outer sheath containing an expandable working channel (Figure 2b) are available. Recent advances in technology include the use of fully portable and disposable hysteroscopic diagnostic and operative systems (The EndoSee® device (CooperSurgical, Trumbull, CT, USA; LiNA OperåScope™ (LiNA Medical ApS, Glostrup, Denmark), and the Omni™ hysteroscope

(Hologic™, Marlborough, MA USA) (Figure 3a) that can be used with three sheath options.

Mechanical hysteroscopic tissue removal systems (mHTR) have been developed to remove tissue from within the uterine cavity. These systems necessitate the use of a bespoke hysteroscope with an offset proximal eyepiece to allow for a straight working channel large enough to accommodate a tissue removal blade. The TruClear™ 5.0 (Medtronic, Minneapolis, USA) and the MyoSure™ (Hologic™, Marlborough, MA USA) mHTR systems use a 0° hysteroscope and the IBS® - Integrated Bigatti Shaver (Karl Storz, Tuttlingen, USA) a 6° optic. The systems come in several sizes but those most suitable for use in an outpatient setting are between 5mm and 6.25mm (Figure 3).

The conventional resectoscope with typical outer diameters of 26-27Fr (8-9mm) has been miniaturised with 16 Fr mini-resectoscopes now available (e.g. Karl Storz SE & Co.KG, Tuttlingen, Germany) (Figure 4) suitable for removal of intrauterine pathologies in the office setting.

Fluid management

Complex hysteroscopic surgery, such as dense adhesiolysis or removal of large and / or FIGO type 2 fibroids, where optimal vision is required and prolonged procedures are likely mandates for the use of an automated fluid management system. Such procedures are not suitable for the outpatient setting. Furthermore, the risk of fluid overload complications, especially when using physiological saline is low. Thus, adequate fluid management can be achieved by simple gravity or pressurised inflow as opposed to automated fluid management systems in the outpatient setting (Umranikar et al., 2016; Clark and Connor, 2020). This is especially true for simple procedures like polypectomy. However, if myomectomy is frequently performed in an outpatient setting then investment in an automated fluid management system is to be encouraged to optimise visualisation and accurately monitor fluid inflow and outflow. Such automated systems include the Fluent fluid control system (Hologic), the Hysteromat (KARL STORZ –Endoskope,

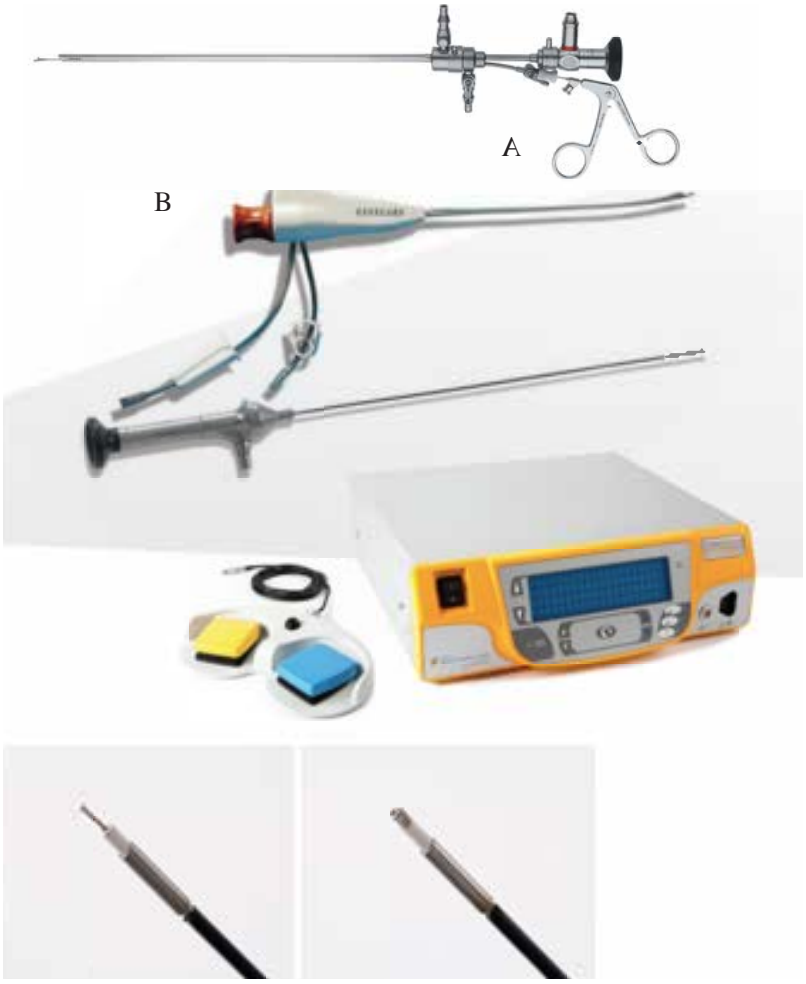

Figure 2: Small diameter operative hysteroscopes suitable /or operative outpatient hysteroscopy . (A) Bettocchi rigid operarive hysteroscope (Karl Storz SE & Co.KG, Tuttlingen, Germany). (B) Alphascope® with Versapoint® bipolor electrodes and generator (Gynecare, Ethicon, Somerville, NU, USA).

Figure 3: Mechanical hysteroscopic tissue removal systems for use in the outpatient setting.
(A) The MyoSure Omni hysteroscope [6.25 mrr. (19 Fr) sheath and 0° optic] (Hologic, Marlborough, Massachusetts, USA); (B) The TruClear™ 5.0 [5-5.6mm sheath and 0° optic] (Medtronic, Minneapolis, USA) system; (C) The lntegrated Bigatti Shaver® [8mm and 6° optic) (Karl Storz, Tuttlingen, USA).

Germany), the Hysterolux fluid management system (Medtronic, USA) and HysteroBalance (Olympus GmbH, Hamburg, Germany).

Instrumentation

Conventional mechanical instruments

A range of finely engineered mechanical instruments designed to pass down 5Fr or larger 7Fr operating channels of rigid operative hysteroscopes, typically </=5.5mm in outer diameter are available. These include scissors, loops, biopsy cups, grasping forceps and snares (Figure 5a). One drawback of these fine mechanical instruments is that skill is required to manipulate them and they lack the strength to remove large and more dense, fibrous pathology and occasionally there can be problems with bleeding (Clark and Gupta, 2005; Garuti et al., 2008; Bettocchi et al., 2004), However, they are simple, safe and effective (Clark and Gupta, 2005; Garuti et al., 2008; Bettocchi et al., 2004) for removing soft polyps in an outpatient setting.

They are reusable but have a limited life due to their fragility.

These conventional, fine mechanical instruments are generally ill-suited to removing denser, submucous fibroids, lacking the necessary strength and cutting power. However, scissors can be successfully used to delineate the fibroid capsule and separate the connective tissue bridges, mobilising the fibroid and removing small fibroids en-bloc. Larger fibroids are less suitable for such an approach because of the risk of bleeding obscuring visualisation.

Mechanical tissue removal systems

Mechanical hysteroscopic tissue removal systems (mHTR) have largely superseded conventional mechanical and miniature electrosurgical technologies for the removal of endometrial polyps in an outpatient setting (Smith et al., 2014; Li et al., 2017). This is because they are extremely effective and easy to use (van Dongen et al., 2008). In contrast, the removal of submucous fibroids in the outpatient setting remains challenging regardless of which technology is adopted (see later) and so no technology is currently considered superior for outpatient hysteroscopic myomectomy.

Mechanical hysteroscopic tissue removal systems (mHTR) avoid the need for electricity and can simultaneously cut and aspirate tissue. The cutting blades or 'shavers' consist of two

hollow metal cylinders with a distal opening or 'cutting window'. The pathology enters the cutting window when negative pressure (suction) is applied. The inner cylinder moves under the operator's control (foot pedal or integral hand-held pump, depending upon the system) to shave away the tissue. A clear view within the uterine cavity is achieved by eradicating tissue debris and blood and the suction provides tissue for histological examination. Repeated insertions of the hysteroscope are not required reducing procedural time, which is of particular importance in the outpatient setting when operating on a conscious patient, as well as reducing the risk of pain, vaso-vagal reactions and air embolus. Three mHTR systems are widely used in the outpatient setting: MyoSure™ (Hologic™, Marlborough, MA USA) (Figure 3a), TruClear™ 5.0 (Medtronic, Minneapolis, USA) (Figure 3b) and the IBS® - Integrated Bigatti Shaver (Karl Storz, Tuttlingen, USA) (Figure 3c). The SYMPHIONTM system (Boston Scientific, Natick, MA) combines a tissue removal system with bipolar radiofrequency energy within an integrated tissue management system but is less widely used outside of the US.

The TruClear™ 5C office system (5-5.6mm) has a bevelled tip easing the use of vaginoscopy and insertion of the hysteroscope in an outpatient setting through which the rotating TruClear™ Soft Tissue Shaver and reciprocating Dense Tissue Shaver can be used. The MyoSure™ system now includes a 'Three-in-One' Omni™ hysteroscope (Figure 3a) that can be used with any of the three new sheaths. The smallest of these is 3.7mm diameter and suitable for diagnostic hysteroscopy. The two operative sheaths are 5.5 mm and 6 mm in diameter. The smaller of the operating scopes can accommodate the MyoSure™ MANUAL, LITE and REACH devices; these can also be used down the larger 6 mm Omni™ scope, as well as the MyoSure™ XL device. The IBS® is larger at 8mm in out the IBS® in outer diameter but the shaving blade is reusable for a finite amount of procedures. A smaller diameter IBS® system suitable for use in an outpatient setting has been developed.

All the available systems consist of an electrical generator that drives the mechanical cutting blades which aspirate fluid and tissue upon attachment to external suction apparatus. The MyoSure™ suite of mHTR systems also includes a manually operated system that avoids the need for an electrical generator, the blades being rotated by repeated squeezing and release of an integrated hand held pump to completely remove polyps (Smith and Clark, 2020).

Electrosurgical equipment

A variety of miniature electrosurgical instruments are available for use in an outpatient setting. These instruments described include miniature 5Fr bipolar electrodes (Clark and Connor, 2005; Cooper et al., 2015; Clark and O'Donovan, 2015) (Figure 2b), 16Fr (5mm) bipolar resecting loops (Papalampros et al., 2009) (Figure 4) and monopolar electrosurgical snares (van Germet et al., 2022) (Figure 5b). The use of electrical energy provides more efficient cutting than the conventional mechanical instruments and also allows for control of bleeding by coagulation of bleeding points. However, the risk of thermal injury to viscera is greater than with mechanical instruments if a uterine perforation is sustained. Complications from fluid overload are however unlikely when operating with electrical energy in an outpatient setting because procedures are shorter, fibroids smaller and more superficial (FIGO types 0 and 1), and normal saline used with the bipolar energy systems (Umranikar et al., 2016; Clark and Connor, 2020).

The successful use of miniature diode lasers has been reported in the outpatient setting (e.g. the Leonardo VR laser system (D.w.L.S.; LeonardoVR , Biolitec, Jena, Germany) to conduct polypectomies, myomectomies and metroplasty (Vitale et al., 2023;

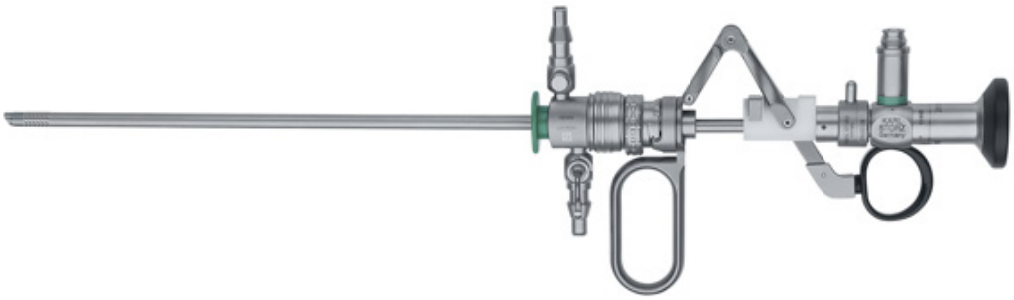

Figure 4: The 16 Fr mini-resectoscope (Karl Storz SE & Co. KG, Tuttlingen, Germany)

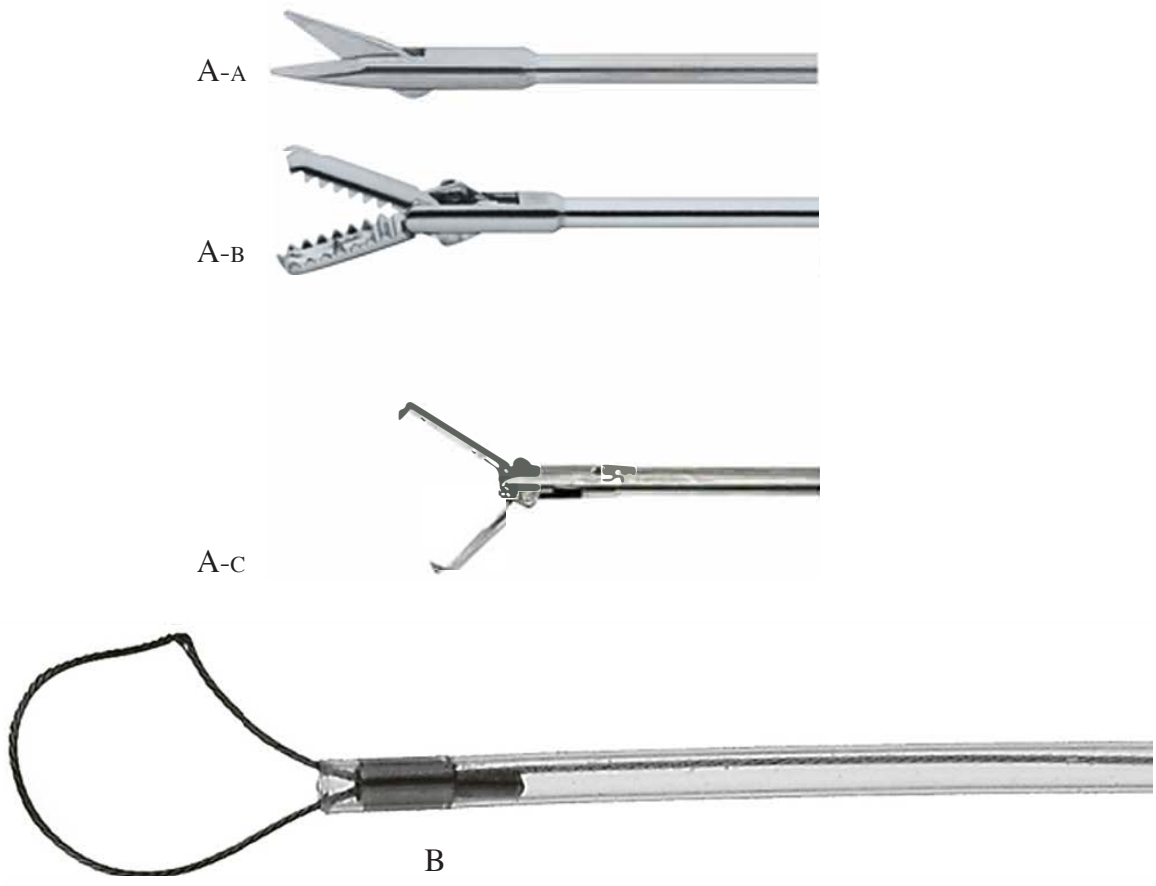

Figure 5: (A) 5Fr mechanical instruments (Karl Storz SE & Co. KG, Tuttlingen, Germany) - (A) Scissors; (B) Grasper; (C) Grasping forceps.
(B) Snare (can cut electrosurgically or be used solely mechanically to excise and retrieve endometrial polyps).

Haimovich et al., 2015; Haimovich et al., 2013; Nappi et al., 2017). However, this technology is not considered further as it is not widely employed.

Techniques

Outpatient polypectomy

Conventional mechanical approach

5Fr and 7Fr 'cold' scissors and / or grasping forceps / biopsy cups passed down the working channel of 4-5.5mm operating hysteroscopes. They can be used to detach and retrieve endometrial polyps. The scissors can be used at the base of the polyp to remove 'en bloc' or to cut larger polyps into pieces. Where grasping forceps are used to avulse the attached polyp rather than to retrieve polyp tissue cut away with scissors or snares, it is important to grasp the polyp at its base under high magnification such that the fine instrument is stabilised by the hysteroscope. The polyp is then squeezed and twisted with the forceps to detach and removed from the uterus by withdrawing the entire hysteroscope with the graspers just exterior holding the polyp tissue. Unlike electrosurgical and most mHTR approaches, the scissors / graspers have the advantage of being reusable. However, movements can be limited and they are relatively fragile so they

are most appropriate for small, soft, solitary polyps. Repeated instrument insertions are often required to remove the entire lesion.

Mechanical tissue removal systems

On accessing the uterus, brief activation of the mHTR within the central cavity will clear the view because suction will remove both turbid fluid, blood and free endometrial tissue fragments. The cutting window should be aligned against the end of the polyp and the tissue will be sucked into the window on activation of the mHTR. In the outpatient setting where patients are conscious, efficient operating is of paramount importance. The operator should avoid a 'stop : start' approach aiming for almost continuous device activation unless adequate visualisation is lost. Furthermore, the operator must ensure that the cutting window is contacted within the polyp tissue at all times such that it cannot be seen rotating. As the polyp is gradually removed, fine rotatory adjustments of the blade handle will facilitate this. Movements should be kept to a minimum to minimise patient discomfort. If the soft polyp is seen to be 'dancing' i.e. vigorously moving within the cutting window, then this indicates an optimal cutting position of the TRS relative to the polyp. Accessing the base of the polyp can be aided by levering the mHTR thereby applying gently to the uterine wall so that the polyp is completely removed (Smith et al., 2014; Smith and Clark, 2020).

Electrosurgery

Electrical resection of endometrial polyps can be achieved using 5Fr miniature bipolar electrodes, bipolar mini-resectoscopes and monopolar snares. Polyps of all sizes can be detached with these technologies although larger polyps over 2cm can be more challenging (Lieng et al., 2009). This is due to the need of longer operating times because of restricted access within the cavity and to the polyp attachment (base), in addition to difficulties manoeuvring the miniature electrodes, and maintaining good visual field.

Miniature bipolar 5Fr electrodes:

The 'en-bloc' technique, detaching the polyp at its base so it can be removed efficiently in one piece, is most commonly used (Clark and Connor, 2020; Smith and Clark, 2020; Cravello et al., 2000). However, whilst polyps are usually soft and compressible, removal with fine 5 or 7Fr grasping forceps / biopsy cups can be difficult through the relatively narrow and fibrous cervical canal. Cervical dilatation is required for larger or more fibrous polyps to facilitate retrieval. The alternative approach is to adopt a 'slicing technique'. This involves cutting the polyps into pieces and using grasping forceps to retrieve the fragments. This technique has the advantage of allowing removal of smaller diameter tissue through the narrow endocervical canal. However, the procedure is prolonged, requiring multiple instrument passes through the cervix. Maintaining an optimal view may be difficult because of endometrial congestion associated with protracted fluid instillation, the creation of tissue debris and the intermittent loss of uterine tamponade.

Mini-resectoscopes:

The electrosurgical cutting loop visualised with an offset distal lens, allows much more manoeuvrability to remove focal pathologies regardless of their location within the uterine cavity than small, straight miniature electrodes. The mini-resectoscope should be used in the same way as conventional larger diameter resectoscopes. The resectoscope controls the resecting loop which is activated in a retrograde fashion, from fundus to isthmus, to minimise the risk of uterine perforation and thermal injury to intra-abdominal visceral structures. The polyp is removed in slices; the cutting loop is placed beyond the distal border of the polyp and repeated, systematic, retrograde electrosurgical cutting movements, facilitated by movement of the hysteroscope or withdrawal of the cutting loop or a combination of both methods, are undertaken until the polyp is removed entirely. The soft, small polyp tissue fragments are either removed spontaneously, with 'blind' polyp forceps after cervical dilatation or a bridge modification to the 16 Fr mini-resectoscope can allow the insertion of 5Fr grasping forceps.

Snares (loops):

Loops can either be used as a simple mechanical snare to retrieve polyps previously detached by other means or as a stand-alone technology with monopolar electrical energy applied via a generator in a non-conducting fluid medium to cut the polyp which is then ensnared and removed (Timmermans et al., 2005; van Gemert et al., 2022). They have the advantage over graspers of providing better traction, so that larger polyps can be negotiated through the cervical canal. However, limited manoeuvrability can make accessing polyps, especially sessile lesion difficult.

Outpatient myomectomy

Conventional mechanical approach

Dense fibroid tissue is too strong for these finely engineered mechanical instruments. However, 5/ 7 Fr scissors can successfully incise the endometrium and delineate the fibroid capsule, separating the

connective tissue bridges thereby mobilising the fibroid. `fine instruments including tiny myomectomy 'screws' and grasping forceps with integral spikes to aid contact with the fibrous tissue have been developed but only very small fibroids can be removed with such instruments, either en-bloc or in pieces. Larger fibroids are less suitable for such an approach, not only because of fragility of the instruments but also because of the risk of bleeding obscuring visualisation.

Mechanical tissue removal systems

The instrument tip must be placed firmly in contact with the submucous fibroid prior to activation. The cutting window is placed within the central portion of the fibroid to create a 'bite' (likened to eating an apple), followed by lateral rotations of the cutting window (likened to spreading butter on toast) (Emmaneul et al., 2005; van Dongen et al., 2008). These manoeuvres are repeated until the fibroid removed. Minimal anterograde or retrograde movements of the mHTR are required and these are only to ensure that the cutting window is placed within fibroid tissue at all times to ensure efficient removal. Once the fibroid capsule has been opened using mHTR, any myometrial component of the fibroid is free to protrude further into the uterine cavity facilitated by uterine contractions. The mHTR system can then be used to mechanically 'lever up' ('spade technique') the fibroid in order to separate the myometrial component of the fibroid from the underlying myometrium along the cleavage plane thereby delineating the capsule. These manoeuvres have some similarities with the 'cold loop' technique described by Mazzon for conventional operating room removal of submucous fibroids (Mazzon., 2015), because the cutting blades of the mHTR are robust in contrast to more delicate electrosurgical cutting loops that are prone to bending / fracturing. These manoeuvres help distinguish the fibroid from the underlying myometrium so that mechanical cutting can be safely continued by ensuring the cutting window is placed within residual fibroid tissue, minimising the risk of inadvertent uterine perforation. An alternative technique that can be used when the cleavage plane is entered with the mHTR device, is to rotate the cutting window 180° which enables the fibroid to be removed from 'below' i.e. from within the myometrium in an 'upwards' direction i.e. towards the uterine cavity.

Electrosurgery

Miniature bipolar 5Fr electrodes:

As with polyps, the fibroid can be detached in one piece 'en-bloc' or in slices. For en bloc removal, the electrode (and in the case of fully intracavity FIGO type 0 fibroids) or resectoscopic cutting loop is placed at the level of attachment of the fibroid to the myometrium and beyond its distal border (Clark et al, 2002; Varma et al., 2009; Bettocchi et al., 2004). Repeated retrograde electrosurgical cutting is then performed by movement of the hysteroscope or withdrawal of the electrode or a combination of both methods. Motions are continued in a systematic way until the fibroid is detached. The inactivated electrode can be used periodically to probe the fibroid to help identify the basal attachment to the myometrium.

For FIGO type 1 and 2 fibroids the 5Fr straight electrode is used to wholly, or partially, circumscribe the endometrium overlying the visible margins of the fibroid, where possible moving the activated electrode in a retrograde direction. Once the fibroid capsule has been opened in this way, the myometrial component of the fibroid is free to protrude further into the uterine cavity facilitated by uterine contractions. The inactivated electrode or a 5Fr grasping forceps can be used to mechanically identify the cleavage plane, separating the intramural component of the fibroid from within the underlying myometrium, by breaking the connecting bridges of fascicular myometrial tissue. In this way, the intramural component of the submucous fibroid becomes increasingly visible as it migrates further into the uterine cavity and becomes more accessible (Istre and Clark, 2020; Varma et al., 2009; Munro et al., 2016). These cutting and mechanical steps are systematically repeated until the fibroid is completely enucleated. Removal of tissue from the uterine cavity is as described for endometrial polyps above using miniature 5Fr bipolar electrodes.

The electrode can then be used to slice the fully or partially detached fibroid into smaller pieces to aid removal from the cavity (Bettocchi et al., 2002) using hysteroscopic or blind instruments like polyp forceps although in reality it is difficult to debulk a fibroid that has been partially or fully detached from the myometrium due to its mobility. Alternatively, the fibroid can be retrieved from the uterine cavity in one piece. This usually necessitates variable degrees of cervical dilatation and blind insertion of instruments such as polyp forceps. Wherever possible, blind instrumentation of the uterus should be avoided to minimise the risk of genital tract trauma. Another option to blind removal or when blind removal is not easily achieved, is to leave the detached fibroid in situ to degenerate and pass spontaneously post-operatively and often during the first menstruation after surgery (Varma et al., 2009; Haimovich et al., 2015). A 'hybrid' procedure can also be performed where a mHTR is used to

remove under direct vision after complete or partial detachment of the fibroid (Munro et al., 2016).

The alternative 'slicing' technique involves placing a straight 5Fr electrode at the distal extremity of the fibroid and a retrograde surgical cut is made to the proximal extremity. Repeated cuts are made in the same furrow so that the fibroid is sliced vertically until the basal attachment with the myometrium is reached (Clark et al., 2002; Varma et al., 2009; Bettocchi et al., 2004). Depending on the shape and size of the fibroid, it can be divided in half or quarters or as many fragments as necessary to debulk using systematic vertical and /or horizontal slices. The cut pieces should be small enough to remove with hysteroscopic grasping forceps.

Mini-resectoscopes:

The cutting loop is placed beyond the distal border of the fibroid and repeated, systematic, retrograde electrosurgical cutting movements, facilitated by movement of the hysteroscope or withdrawal of the cutting loop or a combination of both methods, are undertaken until the fibroid is removed. Resection normally is initiated at the free margin of the myoma, then proceeding in a uniform manner towards its base of implantation within the myometrium. As soon as the visible intracavity portion of the myoma has been removed, the inactivated cutting loop can be gently used to undermine and identify more clearly the myometrial component of the fibroid, separating it from the underlying capsular attachment (Emmanuel and Wamsteker, 2005; Hart et al., 1999; Vercellini et al., 1999; AAGL, 2012; Di Spiezio et al., 2008; Istre and Clark, 2020). To ensure complete enucleation, pink, softer myometrial tissue should be identified; the inactivated cutting loop can be used to help judge the tissue density and delineate the base of the fibroid capsule. The activated electrode is then used to remove any residual fibroid tissue from the base, carefully judging the depth of insertion of the cutting loop.

Attempts may be made during the procedure to coagulate specific bleeding points using the loop if the bleeding persists and is compromising visualisation. Removal of tissue can be achieved in the following ways: (i) the small size of the resected 'chips' allow for spontaneous passage down the cervical canal; (ii) removal by trapping them in the end of the hysteroscope by retracting the inactivated cutting loop and removing the resectoscope; (iii) removal with 5/7Fr grasping forceps passed along an adapted bridge or using an additional operating hysteroscope; (iv) using blind polyp forceps. Some surgeons avoid the formation of free flowing 'chips' of tissue that can obscure vision by removing each resected strip of tissue by immediate removal of the resectoscope followed by re-insertions which can be painful in an outpatient environment.

Feasibility and clinical outcomes

So far we have discussed the practical aspects around removing polyps and fibroids hysteroscopically in the outpatient setting; pain control, equipment and techniques, However, if we are not to cause harm and waste scarce health care resources we need to evaluate the acceptability, feasibility and effectiveness of our interventions. By understanding the impact of our surgery, we can better counsel our patients and optimise clinical care.

Outpatient polypectomy

The evidence-base supporting outpatient hysteroscopic removal of endometrial polyps is more extensive and clearer than for fibroid removal. A systematic review of randomised controlled trials (RCTs) evaluating the effect of hysteroscopic devices on pain experienced by women undergoing operative office hysteroscopy identified seven trials that evaluated technologies for endometrial polypectomy; four compared energy modalities; miniature bipolar electrode resection against resectoscopy (n=1), mHTR (n=2) and diode laser resection (n=1) (De Silva et al., 2020). Two studies compared hysteroscope diameter and one study compared methods of polyp retrieval.

A significant reduction in pain was found using mHTRs rather than miniature bipolar electrosurgical devices ($p<0.001$), smaller diameter resectoscopes ($p<0.001$) and 3.5mm fibreoptic hysteroscopes with 7Fr forceps rather than 5mm lens-based hysteroscopes with 5Fr forceps. In the two studies comparing mHTR with miniature bipolar electrosurgical resection using 5Fr miniature bipolar electrodes (Smith et al., 2014; Pampalona et al., 2015), the earlier study showed a significant reduction in pain when using a mHTR (Smith et al., 2014), whereas the latter one did not (Pampalona et al., 2015). However, the earlier study compared a 5mm diameter hysteroscopic morcellator against either a 3.5mm or 5mm hysteroscope (Smith et al., 2014), whereas the latter one compared the same hysteroscopic morcellation system device against a slightly larger 5.5mm hysteroscope (Pampalona et al., 2015). Both trials were consistent in showing that mHTR was significantly quicker and associated with lower rates of failure (Smith et al., 2014; Pampalona et al., 2015). More than 99% of women found outpatient polypectomy acceptable (Smith et al., 2014). Novel, miniature bipolar mini-resectoscopes have been shown to be feasible and safe in an outpatient setting to remove endometrial polyps

(Dealberti et al., 2016), However comparative data between mHTR and miniature bipolar resectoscopes to guide practice is lacking.

Similarly, the superiority of mHTR was demonstrated in a recent RCT that found that outpatient polypectomy was more successful using a mHTR (Truclear™, Medtronic) compared to an electrosurgical polyp snare (DPS) (Duckbill®, Cook) (95% vs. 59%). Removal using a mHTR was shorter (6 vs. 12 minutes). Pain scores and rates of acceptability were comparable between technologies although it should be noted that 23/66 (35%) were not outpatient procedures as level 3B (Carugno et al., 2021; Carugno et al., 2022) pain control was used (iv propofol administered by a trained sedationist) (van Gemert et al., 2022).

The use of a dual wavelength laser system has been shown to be feasible and safe in an outpatient setting (Nappi et al., 2017). One RCT has compared outpatient polypectomy using miniature bipolar electrosurgery against diode laser, there was no significant difference in pain experienced by women and the rate of adverse events was the same between the two modalities. Polyp resection, however, was quicker with the laser (Lara-Domínguez et al., 2015). Polyp relapse was more common in women randomised to miniature bipolar electrosurgery when compared to diode laser resection at second-look hysteroscopy three months' post-procedure (Lara-Domínguez et al., 2015).

Another systematic review and meta-analysis of RCTs comparing mHTR with conventional resectoscopy for removal of endometrial lesions also identified the same four trials including 392 patients found that successful removal of polyps was more frequent with mHTR than conventional resectoscopy (odds ratio 4.49, 95% confidence interval [CI] 1.94–10.41) and total operative time was shorter with mHTR (mean difference −4.94 minutes, 95% CI −7.20 to −2.68;) (Li et al., 2017). No significant differences in complications were found. Thus it is clear that mHTR is superior to electrical resection of polyps in terms of feasibility and patient experience in an outpatient setting.

A large, multicentre RCT (the OPT trial) comparing outpatient to inpatient polypectomy for abnormal uterine bleeding showed that there was no difference in effectiveness but that the outpatient setting was significantly more cost-effective (Cooper et al., 2015; Clark and O'Donovan, 2015).

Outpatient myomectomy

There is less evidence to guide clinical practice regarding hysteroscopic myomectomy in an outpatient setting compared to hysteroscopic polypectomy. A systematic review failed to identify any RCTs evaluating mHTR for myomectomy but did find eight observational studies (208 used MyoSure and 75 Truclear). The review showed that mHTRs were associated with similar or reduced operative time compared to traditional electrical resectoscopy. However, only two articles reported data about procedures performed in outpatient/office setting both using the MyoSure (FIGO types 0-2) technology (Rajesh and Guyer, 2015; Rubino and Lukes, 2015; Haimovich et al., 2015; D'Alterio et al., 2020). One was an RCT of 42 fibroids (FIGO types 0-1; 1.6-2.9cm) of which 28 were removed in an outpatient setting (Rubino and Lukes, 2015). The office procedures used the following pain management protocol: 800 mg of ibuprofen administered the night before the procedure, and 10 mg diazepam, 10 mg hydrocodone/acetaminophen, and 25 mg phenergan. Topical 2% lidocaine gel was applied to the cervix and a cotton swab coated with 2% lidocaine gel was inserted into the cervical os for 10 min. Two millilitres of 1% lidocaine and 0.25% bupivacaine were injected superficially at the 12:00 position. Ten millilitres of 1% lidocaine and 0.25% bupivacaine were injected approximately 1 to 2 cm deep at the 4 and 8 o'clock positions. Rates of successful fibroid removal were similar regardless of treatment setting and in excess of 97%. Clinical outcomes in terms of improvement in health-related quality of life was similar regardless of treatment setting (outpatient or ambulatory) but the data presentation precluded an evaluation of feasibility and acceptability in an outpatient setting. The other primary study was a small retrospective study published as a conference abstract that reported the successful removal of 14/17 (82%) fibroids in an outpatient setting (FIGO types 0-2) (Rajesh and Guyer, 2015).

One observational study of 28 myomectomies showed the feasibility of outpatient myomectomy using the MyoSure system and quicker post-operative recovery compared to inpatient treatment. However, according to new accepted terminology for treatment setting these were not outpatient procedures as 61% had iv sedation and 7% general anaesthesia (Schieber and Chen, 2016). A series of 124 patients (135 pathologies) from the UK evaluated the use of MyoSure in the outpatient setting using an intracervical local anaesthetic block to remove polyps (109), fibroids (19) and retained products of conception (Georgiou et al., 2018). The MyoSure Classic and Lite devices were used for small fibroids and MyoSure XL for larger fibroids. Complete excision was achieved in 14/19 (73%) of cases. As one would expect, logistic regression analysis showed that incomplete excision was associated with predominantly intramural (FIGO type II)

and larger (maximal diameter > 4 cm) submucous fibroids. Importantly, rates of acceptability were high (>99%) and severe pain reported by only 7% of women from the whole series although pain and acceptability data were not stratified by pathology.

One RCT has been conducted comparing mHTR and bipolar resectoscopy for FIGO type 0 and 1 fibroids and showed that complete resection was comparable (89 % vs. 95%) but 2/45 mHTRs (4%) had to be converted to resection due to the hardness (calcification) of the fibroid (van Wessel et al., 2021). Total procedure time between mHTR and bipolar was similar but set up time was longer for mHTR. This study was conducted in the operating room with pain control level 4 and 5 (Carugno et al., 2021; Carugno et al., 2022) (i.e. spinal and general anaesthesia). Similar randomised studies comparing mHTR and mini-resectoscopy for submucous fibroids in an outpatient setting are required to build upon available comparative observational series to remove selection bias inherent is such study designs. Valero et al (Valero et al., 2022) performed a prospective, cross-sectional, observational study of 80 patients comparing the mini-bipolar resectoscopy with a 5.8 mm (17.5 Fr) thick loop tip and a 30°optic (Invidia-Medical GmbH & Co. KG, Tuttlingen, Germany) and mHTR using the MyoSure Omni hysteroscope (Hologic, Marlborough, Massachusetts, USA) with a 6.25 mm (19 Fr) sheath and 0° optic for outpatient hysteroscopic myomectomy. The pain control protocol was as follows: all patients received 200mcg of Misoprostol for cervical ripening 12 h prior, as well as 10 mg of diazepam and 600 mg of ibuprofen (or some other painkiller in case of allergies) one hour before the procedure. Paracervical block using 1.8 ml of 3% mepivacaine injected in the posterior fornix, at the limit between vaginal and cervical mucosa and in each utero-sacral ligament, at 5 and 7 o'clock. They found clinical outcomes to be comparable between mini resectoscopy and mHTR. These included mean treatment times (13 vs. 17 minutes), rates of complete resection (82% vs. 83%), pain scores >7 (13% vs. 7%) and high levels of patient satisfaction (50% vs. 70%) with both technologies (Valero et al., 2022).

A prospective series of 92 hysteroscopic myomectomies of which 35 were conducted in an outpatient setting using the Gynecare VersascopeTM bipolar system showed complete excision in 19 (54%) cases. Successful removal did not appear to be related to treatment setting (Varma et al., 2009).

The use of the LeonardoVR diode laser system (D.w.L.S.; LeonardoVR , Biolitec, Jena, Germany) is not widely used but small series have shown the feasibility of the technology in an outpatient setting to treat fibroids (Vitale et al., 2023). One series of 43 women described a two-step hysteroscopic procedure, which included preparation of partially intramural myomas with incision of the endometrial mucosa and the pseudocapsule covering the fibroid followed by subsequent excision of the fibroid using the diode laser four weeks later. 79% of fibroids were successfully removed and success rates were higher for fibroids <2cm in diameter. Another outpatient series of 20 patients described vaporisation of the fibroid core using a 980-1470 nm wavelength diode laser inserted through the hysteroscope's working channel. A reduction in fibroid volume and vascularity was observed in most patients at two months after the procedure (Vitale et al., 2023).

Future research

Advances in technologies have facilitated the move to outpatient 'office' operating. However, the main limitation now is feasibility and most of these procedural challenges relate to patient experience, especially pain and acceptability. Thus, more quantitative and qualitative research is needed in this area and evaluation of pain control interventions / protocols. There is a still an urgent need to assess the effectiveness of removing polyps and fibroids on patient outcomes regardless of treatment setting. The efficacy on alleviating abnormal bleeding symptoms seems clear (Cooper et al., 2015; Di Spiezio et al., 2008) but the impact on reproductive outcomes, namely infertility and miscarriage, is lacking. Once we know the answers to these questions then trials can compare the relative merits of outpatient versus operating room setting. It is important that such trials (van der Meulen et al., 2019) clearly define the treatment setting including level of pain control according to the standardised nomenclature produced on behalf of the European Society of Gynaecological Endoscopy (ESGE), Global Congress of Hysteroscopy (GCH) and American Association of Gynecological Laparoscopy (AAGL, 2020; Carugno et al., 2021; Carugno et al.,2022).

Conclusion

The available evidence supports the hysteroscopic removal of endometrial polyps in an outpatient setting. The procedure is safe, feasible, acceptable, effective and cost-effective. Clinical outcomes are not compromised compared to conventional hospital, operating room settings. Mechanical hysteroscopic tissue removal systems should be preferred to conventional mechanical instruments and electrosurgery because the evidence shows that mHTRs are quicker, less painful, more acceptable

and more successful. Proficiency in the various techniques and modalities for performing outpatient hysteroscopic polypectomy can be acquired relatively quickly, especially for acquisition of the requisite skills for successful use of an mHTR.

The situation for removal of submucous fibroids in an outpatient setting is less clear. There is a lack of randomised clinical trials to inform clinical practice. Small, observational series show that outpatient hysteroscopic myomectomy is feasible and acceptable but rates of failure are higher compared to outpatient polypectomy. There is no data to support any particular modality or technique as being superior to another. It seems that the main limitation for outpatient hysteroscopic myomectomy is the size and accessibility of the fibroid. Smaller, mostly intracavity and no-fundal fibroids appear to be most suitable for outpatient hysteroscopic removal. More data are needed to better understand which technologies, method of fluid management, pain control measures etc. are best for outpatient myomectomy. Head to head trials comparing such interventions are needed and also comparing treatment settings. It is of key importance that the recent, internationally agreed nomenclature to define treatment setting and pain control is used to aid appropriate clinical inferences being drawn to inform practice and to enhance generalisability.

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