Table 1: Stages of POP–Q system measurement (adapted from [13]**)**

STAGE	CONDITION
0	no prolapse
I	distal prolapse >1 cm proximal to the hymen
II	distal prolapse within 1 cm of the hymen, either proximal or distal
III	distal prolapse >1 cm below the hymen without complete eversion
IV	complete vaginal eversion

Table 2: Traditional (non-mesh) surgical options for POP [145,146]

Prolapse operation	*Short précis of the operation*	*Advantages*	*Disadvantages*
Posterior Colporrhaphy	Midline plication of rectovaginal fascia and perineal body reconstruction	80-90% success	Constipation, dyspareunia, 30% chance of needing further surgery
Anterior Colporrhaphy	Midline plication of pubocervical fascia	70—90% Success	Urinary Tract Infection, Bladder injury, 30% chance of needing further surgery
Hysterectomy	Removal of the uterus (tubes, cervix and ovaries if a 'total' hysterectomy). Approached laparoscopically, transabdominally or vaginally.	Approximately 80% success rate	Depending on route of hysterectomy: Infection, haemorrhage, visceral injury, voiding changes

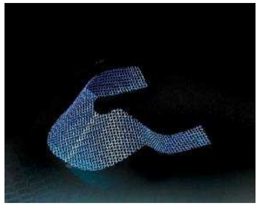
McCall culdoplasty	Involves the uterosacral and cardinal ligaments into the repair of the vaginal vault after removal of uterus at hysterectomy.	76% success rate	Increase surgery time, bowel and ureteric damage
Sacrospinous Fixation	Using a suture to secure vaginal vault to sacrospinous ligament	80-90% success, can be done as part of vaginal hysterectomy	Buttock pain
Moschcowitz procedure	Attempts to prevent posterior prolapses by obliterating posterior cul-de-sac at hysterectomy.	Less successful than McCall Culdoplasty	Increase in surgery time, bowel injury
Colpocleisis	Complete vaginal closure to support apical structures	90-95% success	Haematoma, regret

Table 3: Mechanical properties of the vaginal tissue derived from uniaxial tensile tests (adapted from [147])

Tissue	State	Elastic modulus [MPa]	Ultimate tensile strength [MPa]	Ultimate strain
Healthy vaginal tissue	Pre-menopause	6.65 ± 1.48	0.79 ± 0.05	0.68
	Post-menopause	10.26 ± 1.10	0.42 ± 0.03	0.37
Prolapsed vaginal tissue	Pre-menopause	9.45 ± 0.70	0.60 ± 0.02	0.50
	Post-menopause	12.10 ± 1.10	027 ± 0.03	0.14

Table 4: Types and properties of commercially available synthetic POP Meshes [73,148–154]

Product Name & Manufacturer	Material Component	Key properties	Mesh weight (g/m^2)	Pore size	Mesh Design	Advantages	Disadvantages
Artisyn J&J	poliglecaprone-25 monofilament fiber and non-absorbable PP monofilament fiber	Y-Shaped, partially absorbable mesh with blue and natural stripes	28 (post-absorption)	2.4 x 1.6 mm		Easy to handle, resists wrinkling and folding, partially absorbed to reduce risk of complications	Most of the mesh remains in situ, retaining risks of retraction, extrusion and infection
Gynecare Gynemesh J&J	Monofilament PP	Rectangular, non-absorbable knitted mesh with blue and natural stripes	100	2.47 x 1.68 mm		Very strong, material known to surgeons, easy to cut to custom shape, most	Associated with retraction and extrusion, early associations

						published evidence including retrospective and prospective studies	with dyspareunia
Upsylon™ Y-Mesh Boston Scientific	Monofilament PP	Y-shaped, blue non-absorbable knitted mesh with a natural centre stripe	25	1.7 mm^2		Small surface area to minimise contact with vaginal tissue	No prospective or retrospective evaluations to date
Uphold Boston Scientific	Monofilament PP	Non-absorbable blue mesh with natural center Stripe	25	2.8 mm^2		Small surface area to minimise contact with vaginal tissue	Requires specific sutures and suturing device to fixate

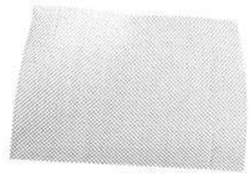
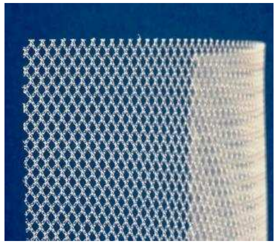
Restorelle Colopolast	Monofilament PP	Rectangular, non-absorbable knitted mesh	20	1.80 x 1.83 mm		Customisable and shaped meshes available, low extrusion rates	Evidence limited to animals, prospective trial in progress
VitaMESH™ ProxyBiomedical	Monofilament PP	Rectangular, non-absorbable mesh	52	2.4 mm^2		Some positive evidence in hernia repair	Evidence limited to animals
Dynamesh – PR soft FEG Textiltechnik mbH	Monofilament PVDF	Rectangular, non-absorbable knitted PVDF	n/a	n/a		Atraumatic, limited tissue reaction	Non-customisable, limited evidence

Table 5: A summary of mesh-related complications and their incidence

[35,102,104,105,155]

Complication	**Symptoms**	**Incidence in the literature**
Mesh erosion	Dependent on organ involved. Typically vaginal bleeding/discharge, dyspareunia, pain, bladder symptoms	3-40% depending on technique
Mesh infection	Pain, dyspareunia, vaginal bleeding/discharge, fistula, abscess, sepsis	0-8%
Mesh retraction	Pain, dyspareunia, defecatory and/or urinary dysfunction	0-100%
Other	Foreign body reactions, fibrosis, chronic pain, recurrent UTIs	Variable

Table 6: Nanofiber based surgical mesh materials and properties

Electrospun material	Fiber diameter	Tensile strength (MPa)	Key findings	Reference
PLA	2.3±0.2 μm	3.5 ±0.4	Using an *in vivo* model and after 90 days of implantation into rabbit abdominal wall, PLA and PU meshes integrated better than commercial available meshes (PP and PVDF), with no sign of inflammation. Also, PLA mesh showed a much greater degree of cell infiltration, neovascularization along with better mechanical properties in comparison to PU mesh.	[115]
PU	1.0 ±0.1 μm	1.9 ±0.2		
PLCL/Fibrinogen	306 ± 91 nm	---	Following human clinical trial, PLCL/Fibrinogen mesh showed a better effect on improving patient anterior vaginal prolapse than PP mesh.	[127,156]

PLGA/PCL	1.0 ± 0.05 µm 8.0 ± 0.2 µm	3.6 ±0.02	Small fibers result in better mechanical behaviour (more ductility and less stiffness) than the 8-µm meshes. Although the small pore dimensions' compromises cell adhesion.	[157]
PLA random	---	1.2 ± 0.1	A broad spectrum of mechanical properties can be achieved according to the fiber alignment. All the scaffolds showed prompt cell infiltration, neovascularisation and collagen formation. PLA mainly aligned scaffolds exhibited the highest values for total collagen production.	[46]
PLA hybrid		3.6 ± 0.2		
PLA mainly aligned		4.8 ± 0.3		
PLA aligned		22.2 ± 1.1		
Nylon	117 ± 7.81 nm	15.4 ± 3.3	All electrospun matrices showed mechanical properties close to the soft pelvic tissues. Both healthy and POP-derived cells showed good adhesion and proliferation onto all the meshes along with the production of new matrix over time.	[128]
PCL/Gelatin	204 ± 37.5 nm	12.4 ± 1.6		
PLGA/PCL	994 ±115 nm	3.5 ± 0.9		
PLA	-----	0.7 ± 0.05	Adhesion, proliferation and metabolic activity of adipose-derived stem cells was positive on both fiber-based scaffolds. The level of collagen type I and III was higher on PLGT scaffolds than on PLA.	[122]
PLGT		0.8 ± 0.04		

			Even though the Young's modulus of PLTG was lower than that of PLA.	
PLA	1.06 ±0.72 µm	0.6 ± 0.04	Scaffolds containing both the derivatives showed better mechanical properties in comparison to bare PLA scaffolds. Fibroblast grown on the ascorbic acid releasing scaffolds produced more collagen respect to the control.	[139]
PLA/L-ascorbic acid	0.99 ±0.60 µm	1.4 ± 0.8		
PLA/ascorbate-2-phosphate	1.04 ±0.56 µm	1.6 ± 1.1		
PU/17-β-estradiol	0.8 ÷ 2.2 µm	5.9 ± 1.5	PU/17-β-estradiol scaffolds exhibited better integration in comparison to both PU alone and PP commercial available meshes. The presence of 17-β-estradiol increased the proangiogenic potential of human adipose mesenchymal stem cells.	[140]
PCL/PEO	7.49 ± 0.45	---		[124]

PCL/PEO/bFGF			After 4, 8 and 24 weeks in a rat abdominal wall model, the explanted samples were tested in terms of mechanical performance and composition of connective tissue. Although the PCL-based mesh revealed a promising approach for new tissue formation, with adequate mechanical strength, the incorporation of bFGF within the implant did not represent a favourable solution either in the short or long term.	
PCL/PEO/bFGF hallow fibers	7.49 ± 0.45	1.4 ± 0.5	Two different fiber-based PCL meshes, hallow and solid, delivering different dosage of bFGF, and CTGF together with rat MSCs were investigated. After 24 weeks of implantation in a rat abdominal wall model, multiple complications were observed except from the solid PCL-CTGF mesh delivering rMSC, which showed better biomechanical as well as biochemical outcomes in comparison to the same mesh incorporated with bFGF.	[143]
PCL/PEO-fibrinogen/bFGF solid fibers	1.61 ± 0.13	1.5 ± 0.4		
PCL/PEO-fibrinogen/CTGF solid fibers				