

STEFANOS GEROULANOS

Surgery in Byzantium

Surgery in Byzantium with respect to the research and results achieved in many other medical fields remained more or less impenetrable, despite its major contribution in conservation, development and transfer of antique knowledge. Byzantine texts provide surprising medical information. Apart from simple surgical procedures, such as incision and drainage of abscesses, they also include fascinating descriptions of severe and very difficult operations. Three of the most important physicians/authors of Byzantium, like Oribasios (325 c.–403 c. A.D.), Aetios of Amida (6th cent. A.D.) and Paul of Aigina (625 c.–690 c. A.D.) describe and perform amazing operations, i.e. craniotomies, strumectomies, aneurysmectomies, stripping of varices, transvaginal hysterectomies.

In 1903 Schoene published the names of 54 “Greek-roman” surgical instruments for the first time¹; in 1907 Milne attempted to attribute names to the Byzantine instruments found their Byzantine names². Maraslis (1983) broadened the list up to 160 instruments³, while Bliquez in 1985 increased these to 237⁴. Several instruments have different forms, shapes and names, obviously made for particular operations, thus increasing the number of the various Byzantine instruments known to over 500. Out of these instruments 207 can be classified according to their special use within several surgical specialties.

In this study one has tried to collect together in the form of the list below the most commonly performed operations and the instruments they employ and to classify them according to today’s surgical specialties. However, instruments such as the scalpel, probes or others that can be placed under different surgical procedures are mentioned – with the exception of two or three of them – only once. For the surgical instruments no citations were given, because they are already all present in Maraslis and Bliquez.

GENERAL SURGERY

Operations: Strumectomy⁵ (with emphasis on recurrent nerve), Herniotomy and Herniorrhaphy⁶, Hydro-⁷ and Varicocele⁸ operation, Entero-⁹ and Omphalocele¹⁰, Laparocentesis¹¹, Gastrorrhaphy¹², Lymphnode and Ganglion excision¹³, Hexadactily operation¹⁴, general abscess incision and drainage¹⁵, Liver and “Spleen”

¹ H. SCHOENE, Zwei Listen chirurgischer Instrumente. *Hermes* 38 (1903) 280–4.

² J. S. MILNE, Surgical Instruments in Greek and Roman Times. Oxford 1907. On ancient instruments cf. several publications of E. KÜNZL, e.g. Medizinische Instrumente aus Sepulkralfunden der römischen Kaiserzeit. *Bonner Jahrbücher* 182 (1982) 1–131; Forschungsbericht zu den antiken medizinischen Instrumenten, in: Aufstieg und Niedergang der römischen Welt, vol. 37/3: Wissenschaften (Medizin und Biologie). Berlin-New York 1996, 2433–639; Medizinische Instrumente der römischen Kaiserzeit im Römisch-Germanischen Zentralmuseum Mainz. Mainz 2002.

³ A. MARASLIS, Η χειρουργική στο Βυζάντιο (Surgery in Byzantium). Athens 1983.

⁴ L. J. BLIQUEZ, Two Lists of Greek Surgical Instruments and the State of Surgery in Byzantine Times, in: J. SCARBOROUGH (Ed.), Symposium on Byzantine Medicine (= *DOP* 38, 1984). Washington, D.C. 1984, 187–204. Cf. IDEM, The surgical instrumentarium of Leon Iatrosophistes. *Medicina nei Secoli. Arte e Scienza* 11/2 (1999) 291–322.

⁵ Paul of Aigina (= P.), *Epitome iatrike*, ed. I. L. HEIBERG, I–II (CMG IX 1–2). Leipzig 1921/1924, 76.

⁶ P. II 106–07; Aetios of Amida (= A.), *Tetrabiblon* (book I–XVI), book XVI ed. S. ZERBOS. Leipzig 1901, 151.

⁷ P. II 102; Aetios of Amida (=A.) XVI 150.

⁸ P. II 105; A. XVI 151.

⁹ P. II 106.

¹⁰ P. II 88.

¹¹ P. II 87.

¹² P. II 89, 129.

¹³ P. II 76.

¹⁴ P. II 84.

¹⁵ P. II 71; Oribasios (= O.), *Collectiones medicae*, ed. I. RAEDER, I–IV (CMG VI 2). Leipzig 1928/33 44, 5 (III 118–20 Raeder).

abscess drainage¹⁶, Scrofulosis¹⁷, Panaritium incision, Ingrowing-nail operation¹⁸, Removal of foreign bodies¹⁹ and Finger-, Arm-, Leg-amputation²⁰.

Instruments: *Akis* (fine needle), *Akone* (sharpener), *Amphimelon* (double probe), *Angistron* (skin retractor), *Angster* (wound adapter), *Apyrenomele* (without olivary end), *Belone* (needle), *Beloulkos* (arrow extractor), *Diocleios* (arrow extractor of Diocles), *Dioster* (arrow pusher), *Doidyx* (pestle), *Dipyrenon* (double olivary probe), *Drepanon* (sickle), *Elasma* (flat part of instrument), *Grammister* (stylus), *Grapheion* (stylus), *Igdion* (mortar), *Kauterion* (cauter), *Kochliarion* (spoon), *Koparion* (probe or scalpel), *Kyathiscos* (spoon like instrument), *Lavis* (forceps), *Mele* (probe), *Mydion* (forceps), *Oxylabidion* (fine forceps), *Parakenterion* (trocar), *Psallis* (scissors), *Pyren* (olivary end of probe), *Ramma* (Suture), *Raphis* (thick needle), *Sarkolabos* (flesh-or-tumour forceps), *Solen* (tube), *Spathe* (spatula), *Spathion* (lancet), *Spathistes* (spatula), *Spathomele* (spatula and probe), *Thyia* (mortar), *Xyster* (Raspatorium). *Ypospathistes* (spatula).

DERMATOLOGY

Operations: Excisions of steatomas or atheromas²¹, corns, tyles and wards²², surgical removal of scrofula²³, incision of furuncles²⁴, excision of lipomas²⁵ and opening of fistulas²⁶. Wound care of ulcers²⁷ and bites with special emphasis on rabies²⁸. Therapy of Erysipelas.

Instruments: *Akanthobolos* (thorn removal instrument), *Etheiologos* (epilation tweezer), *Pyoulkos* (pus extractor), *Tricholabis* (tweezer for hair-removal), *Xyraphion* (razor), *Xystra* (dermarbrasio instrument. or hair-scraper).

NEUROSURGERY

Operations: Trepanation, Craniotomy, Elevation of impressed bone segments, and several operations in cranial fractures²⁹.

Instruments: *Abaptiston* (drill that cannot be baptised e.g. traumatize the meninges), *Aris* (bow-drill), *Choinikes* (hollow drill or crown trepan), *Kephalikon sphyrion* (surgical hammer), *Kephalotrypanon* (trepanation drill), *Kouphister* (ring pad around trephine opening), *Meningophylax* (meningeal protector), *Pilarion* (cap of bandage for hydrocephalus), *Trypane* or *Trypanion* or *Trypanon* (drill).

¹⁶ P. II 86–7; O., *Collectiones medicae* 44, 10 (III 123–4); O., *Synopsis ad Eustathium*, ed. I. RAEDER (*CMG* VI 3). Leipzig 1926, 9, 23, 1 (292 RAEDER).

¹⁷ P. II 76.

¹⁸ P. II 126; O., *Synopsis ad Eustathium* 7,18 (222–3).

¹⁹ P. II 129.

²⁰ P. II 126.

²¹ P. II 74.

²² P. II 128.

²³ As note 17.

²⁴ P. II 71; O., *Collectiones medicae* 44, 29 (III 158).

²⁵ P. II 74.

²⁶ P. II 118–9.

²⁷ P. II 160, 182; A. XVI 59; O., *Synopsis ad Eustathium* 7, 1 and 7, 11 (211–212, 217–8).

²⁸ Aetios of Amida (= A.), *Tetrabilon* (book I–XVI), book XIII ed. S. ZERBOS. *Athena* 18 (1906) 264–92, esp. 266–8.

²⁹ P. II 136–42.

ANGIOLOGY

Operations: Ligation of arteries³⁰, Arteriotomy³¹, Arterial resection in temporal Arteritis³², Aneurysmectomy³³, Varicectomy³⁴ (various methods including stripping), Haemostasis by compression³⁵, Ligation³⁶, Cauterization³⁷ and Haemostyptics³⁸.

Instruments: *Epikroustikon* (hammer like phlebotome), *Exymenister* (membrane cutter), *Katias* (type of phlebotome), *Kauter menoides* (semilunar cauter), *Kirsoulkos* (varix retractor), *Phlebotomos* (phlebotome), *Sikya* (cupping glass).

OPHTHALMOLOGY

Operations: Blepharotomy³⁹, Blepharoplasty of distichiasis⁴⁰, Lagophthalmus operation⁴¹, Ektropion operation⁴², Anabronchismus⁴³, Hydatid cyst removal⁴⁴, Chalazion⁴⁵, Pterygium⁴⁶, Catarrhact operations⁴⁷, Eyelid-sty treatment⁴⁸.

Instruments: *Belone kataraktou* (cataract needle), *Belone parakenterios* (couching needle), *Blepharodistoleus* (eyelid opener), *Blepharokatochon* (eyelid retractor), *Blepharotomon* (eyelid scalpel), *Blepharoxyston* (fine raspatorium), *Melotes* (perforated probe), *Ophthalmostates* (instrument for the fixation of the eye), *Pterygotomos* (pterygion remover), *Ptilon* (hair remover), *Smilion anarrhaphikon* (eyelid knife).

EAR-NOSE-THROAT

Operations: Resection of Nose-polyps⁴⁹, Rhinoplasty after nose accident, Retroauricular acoustic pore opening⁵⁰, plastic ear-reconstruction⁵¹, Reposition of mandibula luxation⁵², Maxilla and mandibulafixation⁵³, Tooth-extraction⁵⁴, Sialolithiasis operation⁵⁵, Uvulectomy⁵⁶, Tonsillectomy⁵⁷, Tracheostomy⁵⁸.

³⁰ P. II 48.

³¹ P. II 47; O., Synopsis ad Eustathium I, 12 (12) .

³² P. II 48.

³³ P. II 75; O., Collectiones medicae 45, 23–24 (III 179–81).

³⁴ P. II 125; O., Collectiones medicae 45, 21 (III 177).

³⁵ P. II 354.

³⁶ P. II 74, 48; O., Collectiones medicae 50, 52 (IV 68–9).

³⁷ P. II 84; A. XVI 62.

³⁸ O., Collectiones medicae 50, 52 (IV 68–9).

³⁹ P. II 56–7.

⁴⁰ P. II 51.

⁴¹ P. II 54.

⁴² P. II 55.

⁴³ P. II 55.

⁴⁴ P. II 56.

⁴⁵ P. II 58.

⁴⁶ P. II 58.

⁴⁷ P. II 60.

⁴⁸ P. II 58.

⁴⁹ P. II 64.

⁵⁰ P. II 62.

⁵¹ O., Collectiones medicae 45, 26 (181–2).

⁵² P. II 163; O., Collectiones medicae 49,28 (IV 44).

⁵³ P. II 145; O., Collectiones medicae 46, 3 (III 214–5).

⁵⁴ P. II 66.

⁵⁵ O., Collectiones medicae 45, 6 (III 164–5).

⁵⁶ P. II 68.

⁵⁷ P. II 67.

⁵⁸ P. II 70.

Instruments:

- in Otology: *Iris otikos* (ear syringe), *Klyster otikos* (ear clyster), *Melotes* or *melotres* (ear probe), *Otenchytes* (ear rinser), *Otoglyphis* (ear-chisel), *Labis leptotate* (extra fine forceps), *Rhinotorinion* (small file).
- in Rhinology: *Polyposphaktes* (Polyp cutter), *Polypotomos* (polyp knife), *Polypoxystes* (nose-polyp remover), *Rhineclytes* (nasal syringe), *Rhinotorinion* (small file), *Rhinospation* (nose-knife), *Smilarion stenon* (nose-polyp lancet), *Spathion polypikon* (semilunar nose-polyp knife).
- in Laryngology: *Akanthobolos* (pharyngeal forceps), *Angylotomos* (curved tonsil knife), *Antiotomon* (tonsil knife), *Antoptra* (pharyngeal mirror), *Mydion* (shell-like forceps), *Staphylagra* (uvula remover), *Staphylepartes* (uvula lifter), *Stapghylokaustes* (uvula cauter), *Staphylolabis* (uvula forceps), *Staphylotomos* (uvula knife).
- in Stomatology: *Bouglosson* (tongue scraper, or tongue depressor), *Daktylethra* (finger stall), *Lithanaboleus* (parotid duct stone hauler), *Sarkolabis* (flesh pincer), *Sphenarion* (wedge to keep mouth open), *Stomatodiatoleus* (mouth opening instrument).
- in Odontology: *Odontagra* (tooth extractor), *Odontoxyster* (tooth scaler), *Rizagra* (tooth root forceps), *Smyris* (emery).

BREAST AND THORACIC SURGERY

Operations: Resection of breast tumors⁵⁹, Mastectomy⁶⁰, Combined mamma preserving tumor resection and cauterization⁶¹, Incision of breast abscess⁶², Removal of milk-stones⁶³, Excision of necrosis and fistulas⁶⁴, Gynaecomasty operation⁶⁵, Rib resection⁶⁶, Drainage of empyema⁶⁷, Separation of siamese twins⁶⁸ (the first in the world).

Instruments: *Ekkopeus* (bone cutting instrument), *Parakenterion* (trocar), *Platymele* (flat probe), *Pleurokops* (rib cutter), *Pleuroprister* (rib saw), *Rine* (file).

VISCERAL SURGERY

Operations: Includes several unclear abdominal operations and others mentioned under “general surgery”⁶⁹.

Instruments: *Enterophylax* (intestinal spatula), *Koparion hydrokelikon* (hydrocele dissector), *Parastoleus* (stomach instrument), *Pyalos* (bathing tub for treatment of enterocele), *Siphon* (drainage tube for hydrocele).

⁵⁹ P. II 84.

⁶⁰ P. II 85; A. XVI 60–4.

⁶¹ A. XVI 61, 40–4.

⁶² O., *Collectiones medicae* 44, 5 (III 164); O., *Eclogae medicamentorum*, ed. I. RAEDER (*CMG* VI 2). Leipzig 1933, 97 (IV 273–7); A. XIII 39.

⁶³ O., *Collectiones medicae* 45, 12 (III 167); O., *Synopsis ad Eustathium* 7, 39 (237).

⁶⁴ O., *Collectiones medicae* 44, 19–20 (III 133–42); A. XVI 58.

⁶⁵ P. II 86.

⁶⁶ O., *Collectiones medicae* 44, 8 (III 122–3).

⁶⁷ O., *Collectiones medicae* 44, 7 (III 121–2); P. II 84.

⁶⁸ Theophanes Continuatus, *Chronographia* 433 (BEKKER); John Scylitzes, *Synopsis Historiarum* 232 (THURN). First analysis in G. E. PENTOGALOS – J. G. LASCARATOS, A surgical operation performed on siamese twins during the tenth century in Byzantium. *Bulletin of the History of Medicine* 58 (1984) 99–102; see also S. GEROULANOS – F. JAGGI – J. WYDLER – M. LACHAT – M. CAKMAKCI, Thoracopagus Symmetricus. Zur Trennung von siamesischen Zwillingen im 10. Jahrhundert n. Ch. durch byzantinische Ärzte. *Gesnerus* 50 (1993) 179–99.

⁶⁹ P. II 129.

GYNAECOLOGY AND OBSTETRICS

Operations: Transvaginal hysterectomy⁷⁰, Drainage of uterus empyema⁷¹, Operation of cervix varices⁷², Nymphectomy⁷³, Operation of hymenal, vaginal and uterus atresia⁷⁴, Resection of pudendal, vaginal and cervical Condylomas⁷⁵, major improvements in irregular birth: Use of forceps, Embryotomy, Support of genitals during birth⁷⁶, Manual extraction of placental rests, Manual cleansing of uterus in postpartal infection⁷⁷, Operation on hermaphrodites⁷⁸.

Instruments: *Chytra* (fumigation apparatus), *Daktylethra* (finger stall), *Dioptra*, *Dioptrion*, *Dioptron* (vaginal specula), *Diphros maiotikos* (gynaecological chair), *Diphros paredros* (chair for births and fumigation), *Embryoulkos* (midwife forceps), *Embryotomos* (embryotome), *Embryothlastes* (spike for dispatching a fetus), *Kephaloklastes* (cranioclast), *Katiadion/Katias* (dead-embryo chisel), *Metranyktes* (uterus dilatator), *Mentrenchytes* (uterus lavage instrument), *Metroskopion* (speculum), *Onyx* (fish-hook-like instrument for extraction of dead fetus), *Pessos* (pessary), *Physarion* (syringe).

UROLOGY

Operations: Circumcision and phimosis operation⁷⁹, Hypospadias operation (building neourethra)⁸⁰, Resection and cauterization of condylomas⁸¹, Catheterization of bladder and lavage⁸², Transurethral and transvaginal cystolithotrypsic⁸³, Transvaginal and transperineal cystolithiasis removal, Castratio⁸⁴, Hermaphrodites operation⁸⁵.

Instruments: *Avliskos* (small tube, reed), *Kalamis pterou* (shaft of bird's feather), *Kalamiskos* (drainage tube), *Katheter* (catheter), *Kauloklyster* (urethra clyster), *Lithanaboleus* (stone extractor), *Lithokopos* (stone cutter, scalpel), *Lithotomos* (scalpel for lithotomy), *Lithoulkos* (stone extractor), *Skenorrhaphion* (frenulum preaputii needle), *Skolops* (urethra lancet), *Syringion* (small tube, fistula).

PROCTOLOGY

Operations: Haemorrhoidectomy (incl. Ligation and cauterization)⁸⁶, Fistulotomy and Fistulectomy⁸⁷, Seton technique⁸⁸, Perianal abscess drainage⁸⁹, Anal atresia operation⁹⁰.

Instruments: *Aimorrhoidokaustes* (haemorrhoidal cautery), *Askoma* (wine skin, bellow), *Abliskos* (small tube, reed), *Brochos* (ligature), *Dioptra* (speculum), *Dioptron mikron* (small speculum), *Diastoleus* (dilatator), *Edroskopion* (anal speculum), *Eneter* (enema syringe), *Keras* (tube of clyster), *Klyster* (clyster), *Emispathion* (half-sword, lancet), *Ipoterion* (small tube from papyrus), *Organon drepanoides* (fistula knife), *Syringotomon* (fistula knife).

⁷⁰ A. XVI 109.

⁷¹ P. II 113; A. XVI 134–6.

⁷² A. XVI 147.

⁷³ A. XVI 152.

⁷⁴ A. XVI 146.

⁷⁵ P. II 124.

⁷⁶ P. II 114–5.

⁷⁷ P. II 118.

⁷⁸ P. II 112.

⁷⁹ P. II 95; O., *Collectiones medicae* 50, 5 (IV 58).

⁸⁰ P. II 94; O., *Collectiones medicae* 50, 3 (IV 57).

⁸¹ P. II 97; O., *Collectiones medicae* 50, 8 (IV 59–60).

⁸² P. II 98; A. XVI 149.

⁸³ P. II 99; A. XVI 149.

⁸⁴ P. II 111; A. XVI 149.

⁸⁵ P. II 112.

⁸⁶ P. II 173.

⁸⁷ P. II 118–20; O., *Collectiones medicae* 44, 12, 44, 19, 44, 20 (III 125–8, 133–5, 135–42).

⁸⁸ P. II 120; O., *Collectiones medicae* 44, 21 (III 142–4).

⁸⁹ O., *Collectiones medicae* 44, 10 (III 123–4).

⁹⁰ P. II 124.

TRAUMATOLOGY AND ORTHOPEDICS

Operations: All possible reductions of simple and complicated bone fractures⁹¹ and repositions of luxation⁹², extractions of arrows, spears etc. including Gastro-, Duodeno-, Jejuno-, Colono-, and Vesicorhaphy⁹³.

Instruments: *Anaboleus* (elevator), *Antiboladion* (bone lever), *Beloulkos* (arrow or bullet forceps), *Dioster* (impellent), *Ekkopeus* (bone cutting forceps), *Gamphoter* (chisel), *Mele traumatike* (specillum vulnearium), *Mochliskos* (bone lever), *Ostagra* (bone forceps), *Ostanaboleus* (bone lever), *Ostenchytes* (bone irrigator), *Osteokopos* (bone cutting instrument), *Perilabeus* (bone reduction instrument), *Perixyster/s* (raspatorium), *Prion* (saw), *Rizagra* (bone remover), *Narthex* (melleus), *Rine* (rasp), *Spathe ipotris* (reduction instrument), *Sphenarion* (cuneolus), *Spheniskoi* (small cuneoli), *Sphyra*, *Spyrion* (hammer), *Xyster* (raspatorium), *Xystron* (scraper).

WOUNDCARE

Operations: Wound cleansing, Wound cauterizing, Wound excision, with several plastic corrections of the wound.

Instruments: *Angter* (pincer and/or bandage), *Atherologion* (foreign bodies remover), *Desmos* (bonds of surgical bed), *Epidesmos* (bandage), *Iska* (sponge-like plant growing on trees), *Lemniskos* (woolen thread), *Likonimos* (ligature?), *Motos* (wound powder and/or gauze, etc.), *Motophylax* (bandage to keep motos in place), *Pessos* (wick or pessary), *Ptygmation* (gauze), *Spongos* (sponge), *Tainia* (strap, ribbon), *Tiltos* (lint), *Telamon* (bandage and/or tourniquet), *Xanton* (lint).

UNCLASSIFIED

Operations: Several operations cannot be clearly classified under any one specialty. They have been omitted from this list. There are, however, several instruments that were of importance. They could have been used in several specialties.

Instruments: *Charaktes* (stylus?, trephine?), *Cherniboxeston chalkoun* (copper wash basin), *Deltarion* (deltashape instrument, cautery?), *Deltos* (medical box), *Diedrion* (twin chairs), *Encheiridion* (instruments case), *Ipoterion* (papyrus stent to hold solenarion), *Kyathos* (spoon-like instrument ?), *Kyrtis* (strainer), *Lekanis* (washing bowl), *Louterion* (bathing-tube), *Physiter* (air bellows), *Prasia* (?), *Skythomyle* (sort of a probe).

The list of instruments presented above is also indicative of the need for specialized medical instruments and of their wide use⁹⁴. It also enlightens our knowledge as to the quality of medicine practiced. Most of these types of instruments are still in use and 30% of them, still today, bear the same name in Modern Greek. This is also valid for many surgical instruments of today, that have kept the same name even in English (approx. 10%), e.g. *Kauter-cautery*, *Trypanon-trepan*, *Embryotomos-embryotome*, *Katheter-catheter*, *Pessos-pessary*. Other instruments' names kept in English retained the Latin derivative of the original name (e.g. raspatorium, forceps, spatula, trocar, or cuneolus), underlining the great influence of Byzantine medicine on the West⁹⁵.

⁹¹ P. II 129, 136, 142, 146, 148–63; O., *Collectiones medicae* 46, 4 and 47, 2 (III 215, 242–3).

⁹² P. II 163–81; O., *Collectiones medicae* 46, 4 (III 215).

⁹³ P. II 129.

⁹⁴ However, compare the rather sceptical position (taken against a frequent use of chirurgical techniques in the middle and late Byzantine period), expressed by E. KISLINGER in *BZ* 94 (2001) 878.

⁹⁵ Cf. K.-D. FISCHER, "Universorum ferramentorum nomina". Frühmittelalterliche Listen chirurgischer Instrumente und ihr griechisches Vorbild. *Mittellateinisches Jahrbuch* 22 (1987) 28–44.