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Electrosurgery

Use and practical tips



Hoyland Medical
Service and quality to the medical profession

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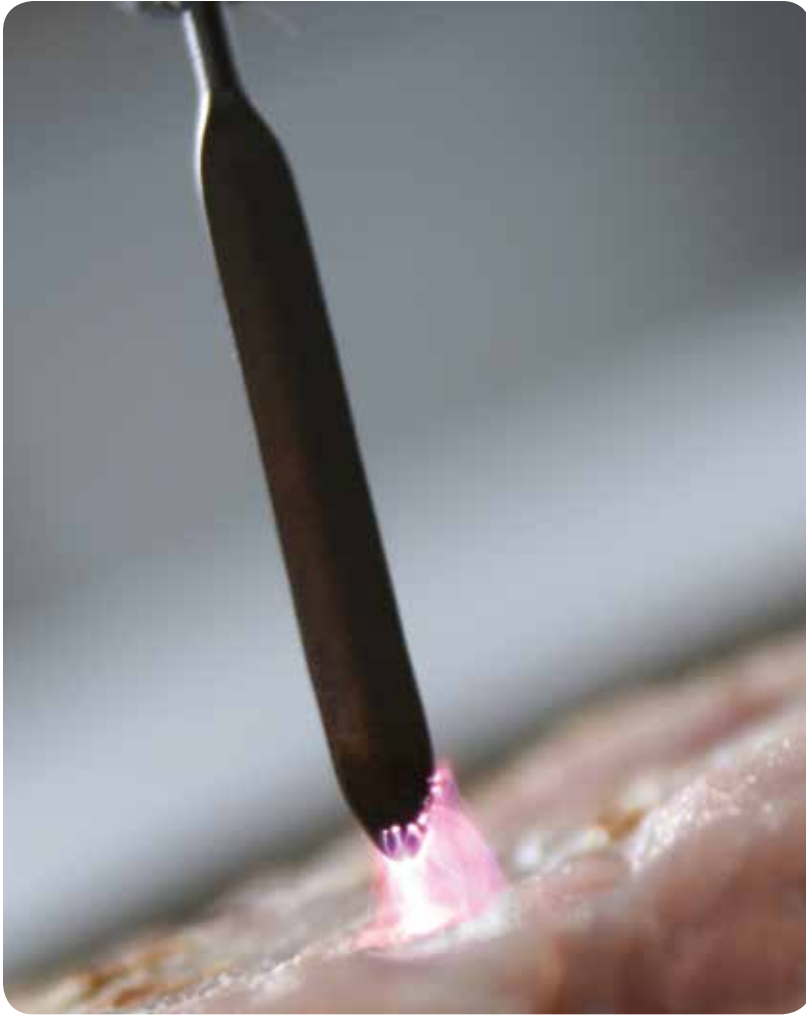
Important information

While Erbe Elektromedizin GmbH has taken the greatest possible care in preparing this brochure and compiling the recommended settings, we cannot completely rule out errors. The information and data contained in the recommended settings cannot be used to justify any claims against Erbe Elektromedizin GmbH. In the event of compelling legal justification for a claim, liability shall be limited to intent and gross negligence.

Although the information on recommended settings, application sites, duration of application and the use of instruments is based on clinical experience, individual centers and physicians also favor settings other than those recommended here. This information is intended only as a guideline and must be evaluated by the surgeon for applicability. Depending on individual circumstances, it may be necessary to deviate from the information provided in this brochure.

Medicine is constantly subject to new developments based on research and clinical experience.

This is another reason why departing from the information provided here may be appropriate.



HF surgery, also called electrosurgery, radio frequency surgery and diathermy, is the most frequent surgical procedure performed in the OR. Nearly every operating room in the world has a high-frequency surgical device which is used in all surgical fields, in hospitals and at the offices of private practice physicians alike. Users have numerous electrosurgical instruments available to them – for open surgery, laparoscopic procedures and flexible endoscopic procedures.

Electrosurgery has established the prerequisites for trend-setting new therapy options, in particular for minimally invasive techniques.

Benefits of the thermal effect in medicine



The higher the current density and voltage, the more pronounced the hemostasis effect



VIO electrosurgical unit with display for CUT and COAG settings

In electrosurgery, high-frequency electrical energy is applied to biological tissue for:

- ☑ Cutting
- ☑ Coagulation (hemostasis)
- ☑ Devitalization (destroying) of tissue
- ☑ Thermofusion (vessel sealing)

HF alternating current of at least 200 kHz is transmitted to the patient's bodily tissue through an instrument (electric conductivity). The electrosurgical unit provides a suitable form of current which is converted into heat and has the following effects on the tissue:

INFLUENCING FACTORS ON THE THERMAL EFFECT

Tissue properties:

If the cutting electrode is advanced through the tissue with varying electrical resistance, e.g. muscles or vessels, the electrosurgical unit adjusts the power voltage. For example, fat and glandular tissue have a higher electrical resistance. Regulation is therefore necessary in order to generate the same tissue effect.

Power dosage:

The electrosurgical unit's automatic power dosing enables a homogeneous, reproducible cutting effect, independent of the influencing factors of tissue, type of electrode and operating mode. The sensors of modern, regulated electrosurgical units continuously monitor current, voltage and electric arc intensity and set the dose to an optimal power level according to need. The principle: as much power as necessary, as little as possible. The objective: more safety for patients and surgeons.



The larger contact area of the spatula electrode produces a stronger coagulation effect...



... compared to finer needle electrodes

Operating mode:

The various operating modes, such as CUT and COAG modes, produce various tissue effects and are therefore set to the respective application on the surgical device by the surgeon (cutting, coagulation, tissue devitalization or thermofusion) (see Figure 2).

Type of active electrode:

Higher power is achieved through a larger electrode area (e.g. a spatula electrode, see Figure 3) compared to a smaller electrode (see Figure 4). The hemostasis effect at the incision edges is more pronounced with a spatula electrode.

Incision placement:

The incision quality is largely independent due to the regulation but can be influenced by the cutting speed and depth.

For more info, refer to:

VIO family leaflet, no. 85140-190

Principles of electrosurgery brochure, no. 85800-103

THERMAL EFFECTS ON BIOLOGICAL TISSUE

37-40°C

None

From ~ 40°C

Hyperthermia:

initial tissue damage, edema formation, depending on the duration of application, the tissue can recover or die (devitalization)

From ~ 60°C

Devitalization (destruction)

of the cells, shrinkage of the connective tissue through denaturation

~ 100°C

Vaporization of the tissue fluid, depending on the speed of vaporization:

- Tissue shrinkage through desiccation (drying out) or
- Cutting due to mechanical tearing of the tissue

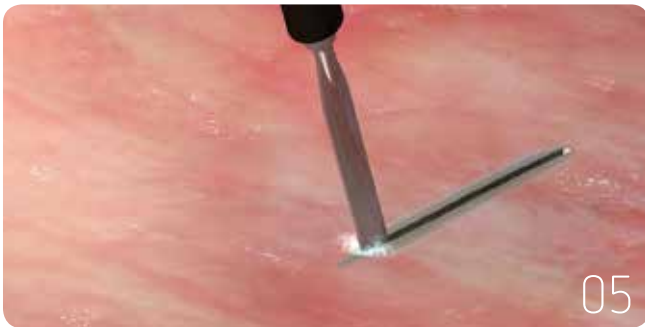
From ~ 150°C

Carbonization

From ~ 300°C

Vaporization (evaporation) of the entire tissue

Source: J. Helfmann, Thermal effects. In: H.-Peter Berlien, Gerard J. Müller (Ed.); Applied Laser Medicine. Published by Springer Verlag, Berlin Heidelberg, 2003.



Electrosurgical incision with a spatula electrode



Devitalization of a lesion with argon plasma coagulation

CUTTING

05,06

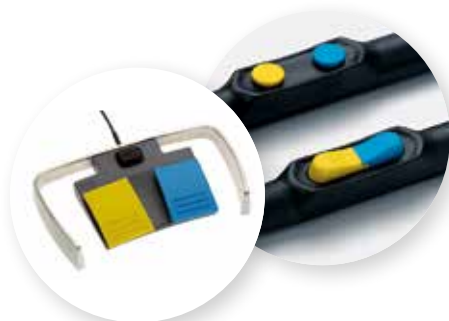
Cutting effects occur at voltages of above 200 V by the formation of electric arcs between the electrode and tissue. Electrical energy is converted into heat with temperatures of 100 °C or higher. Intracellular and extracellular fluid is vaporized, cell membranes are destroyed.

These microcellular vaporizations result in a high-frequency surgical incision with coagulated zones at the incision edges (see Figure 5). Electrosurgical cutting instruments include needle, spatula and snare electrodes.

Other features of the electrosurgical incision:

- ☑ Precise incision placement without mechanical pressure on the tissue
- ☑ Reproducible hemostasis at the incision edges (coagulation effect), less blood loss

The cutting function is indicated in yellow on the electrosurgical pencil or foot switch. The user can choose between various electrosurgical pencils or foot switches in various designs according to his or her work style (see Figure 6a+b).



According to international standards, yellow stands for cutting and blue for coagulation

DEVITALIZATION

07

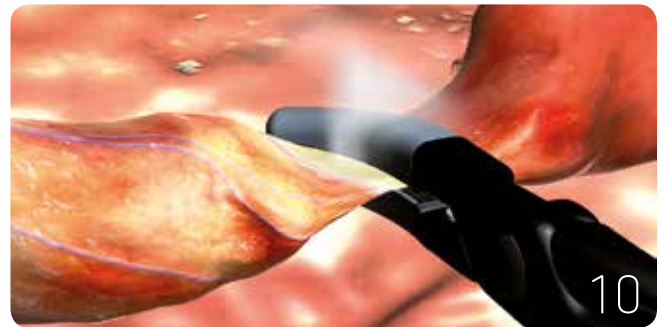
This electrosurgical technique is used for the targeted destruction of tissue anomalies, lesions and tumors.

Cell damage is irreversible starting at a temperature of 50–60 °C. Argon plasma coagulation – as a non-contact procedure (see Figure 7) – is the procedure of choice in bronchial and gastroenterological endoscopy (see the “Argon plasma coagulation” chapter).

Postoperatively the devitalized tissue is decomposed by metabolic processes in the body, which is why this procedure is called ablation.



Contact coagulation with bipolar forceps



Vessels are reliably thermofused using the BiClamp

COAGULATION 08,09

The conversion of electric energy into heat creates tissue temperatures in the range of 60 to 100 °C during coagulation. Intracellular and extracellular fluid is evaporated, without the cell structures being destroyed.

The effects of tissue coagulation:

- Protein molecules are denatured
- Tissue is shrunk
- Vessels are sealed
- The consequence of these processes: hemostasis

Coagulation can be applied in direct contact with the tissue, e.g. with a ball electrode, forceps or clamp (see Figure 8), but can also be non-contact. Depending on the type of electrode and the coagulation mode, either punctiform or large-area coagulations occur. The current strength and duration of application influence the penetration depth of the coagulation effect. In non-contact application, the high frequency current is transmitted through electric arc formation. The coagulation button is blue on the electro-surgical pencil or foot switch.

The user can preset various coagulation modes on the electro-surgical unit and vary and modify these depending on the procedure (see Figure 9).



09

In addition to selecting the mode, the user can also set effects on the display

THERMOFUSION (VESSEL SEALING) 10

While coagulation is primarily used for hemostasis and devitalization, thermofusion seals vessels and "tissue bundles" before separation. Neither clips nor sutures are required for vessels up to 7 mm in diameter*; thermofusion prevents secondary bleeding.

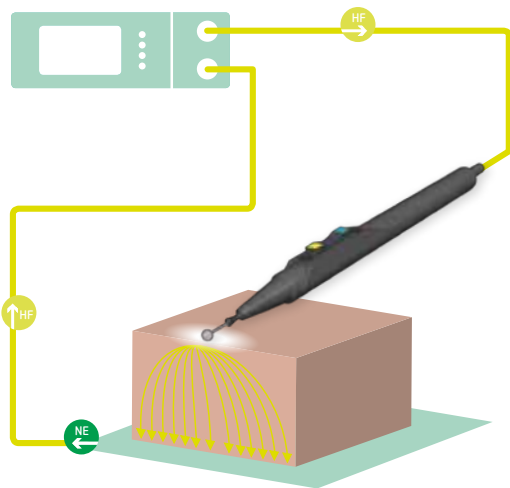
The tissue is gripped with the BiClamp instrument and thermofused with the appropriate type of current of the VIO system in BiClamp mode (see Figure 10). An AUTOSTOP function deactivates current application as soon as optimal thermofusion has been achieved. A considerable advantage of the BiClamp procedure is that the thermofusion is limited to the gripping areas of the instrument. Thermal lateral damage is minimized and surrounding tissue is spared.

In many areas of application, e.g. in general surgery (thyroid resection) or gynecology (vaginal hysterectomy), this aspect is advantageous from a safety point of view.

Surgeons have various BiClamp instruments at their disposal for open surgery and laparoscopic procedures.

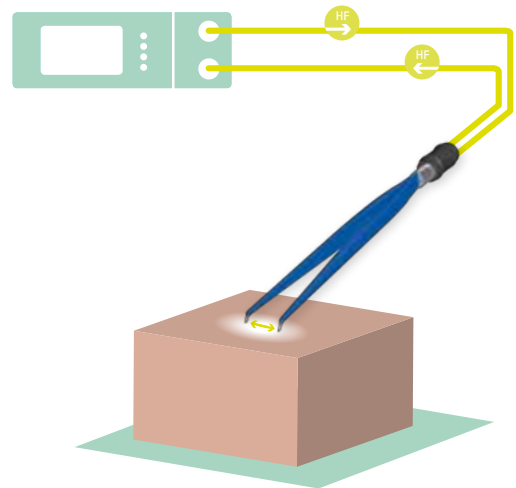
* individual models, depending on the specification

Electrosurgical procedures



11

Electrical circuit during monopolar surgery



12

Current flow during bipolar electrosurgery

MONOPOLAR TECHNIQUE

11

In monopolar electrosurgery, HF current flows in a closed loop – from device to instrument, through the patient's body to the patient plate and from there back to the device (see Figure 11). The current strength is the same at each point in the electrical circuit, i.e. at the distal end of the surgical instrument, the active electrode, just like at the "passive" patient plate.

At the application point the high current density brings about an effect, such as an incision or coagulation, while the surface of the skin at the large-area patient plate is heated only minimally due to the low current density and is hardly perceptible to the patient.

Because current flows throughout the patient's body with the monopolar technique, several aspects must be kept in mind to ensure safe use. Additional recommendations for this are provided in the "Tips for safe use" chapter. Nevertheless, the monopolar technique has its advantages over the bipolar technique. For example, monopolar cutting electrodes are easier to handle.

BIPOLAR TECHNIQUE

12

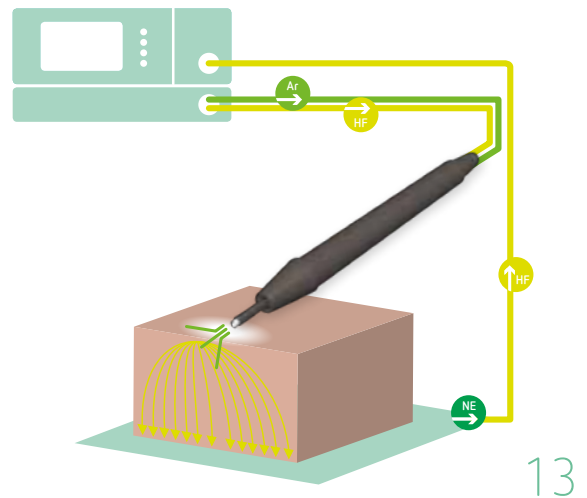
In the bipolar application of electrosurgery, instruments with two integrated active electrode tips are needed. Current only flows in the defined tissue region between both poles and not through the patient's body (see Figure 12). A patient plate is not required in the bipolar technique; the potential risks of monopolar electrosurgery do not apply.

The bipolar technique is particularly advantageous for sensitive procedures such as in neurosurgery, but also for ear, nose and throat, gynecological and minimally invasive surgery.

Classical bipolar instruments are electrosurgical forceps or thermofusion instruments for vessel sealing as well as laparoscopic cutting instruments.

The advantages of the bipolar technique at a glance:

- ☑ No patient plate required
- ☑ Only small leakage currents occur
- ☑ The risk of unintentionally burning the patient when touching conductive objects is minimal
- ☑ Less electrical interference from pacemakers or other devices that are connected to the patient (ECG, EEG)



APC is a special form of monopolar electrosurgery

ARGON PLASMA COAGULATION (APC)

13

A special form of monopolar electrosurgery is argon plasma coagulation, during which current is transmitted through ionized argon (argon plasma). Electric arcs ignite without direct contact of the probe to the tissue (see Figure 13).

APC is used for coagulating diffuse bleeding as well as to devitalize punctiform or larger tissue anomalies. The advantage of this non-contact technique is that the instrument cannot adhere to the coagulated tissue. Tearing of the tissue is prevented. The coagulated area is homogeneous and without gaps thanks to the technique: Due to resistance changes, the APC beam automatically turns its focus from coagulated to less coagulated areas after a tissue resection.

The main area of application of APC is interventional gastroenterology for endoscopic therapy of bleeding and devitalization of tissue structure anomalies. APC is also used in open surgery and interventional bronchoscopy.

The APC modes are as follows:

- ☑ PULSED APC (with pulsating APC beams)
- ☑ FORCED APC (with intense hemostasis effect)
- ☑ PRECISE APC (for fine effects)

The advantages of APC in the gastrointestinal tract:

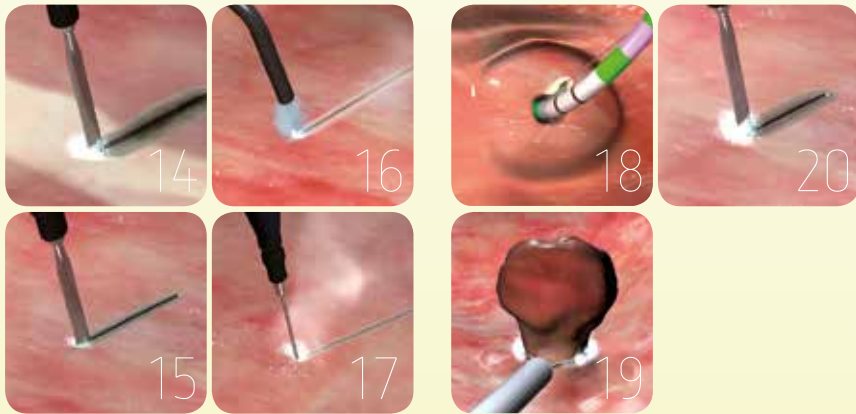
- ☑ Fast, comprehensive coagulation of superficial bleeding
- ☑ Dosable thermal penetration depths
- ☑ Low risk of perforation, including when used on thin-walled structures
- ☑ Minimal smoke generation; good visibility of the surgical target area
- ☑ Minimal carbonization, good wound healing
- ☑ APC has fewer complications and is less expensive than laser treatment

Argon-supported cutting

Various effects work together during argon-supported cutting. The result is minimal carbonization and less smoke gas generation.

Overview of CUT and COAG modes

CUT



HIGH CUT 14

Suitable for cutting inside fatty structures or under water (e.g. TUR). Strong hemostasis at the incision edges. Control of arc intensity.

AUTO CUT 15

Standard mode for cutting with minimum necrosis and reproducible cutting quality.

ARGON AUTO CUT 16

Mode for argon-supported cutting. Minimum carbonization, minimum smoke plume development. Results in a good post-operative healing process.

PRECISE CUT 17

For very fine cutting with precise power adjustment in effect levels. For example, in microsurgery with very fine cutting instruments.

ENDO CUT I 18

Fractionated cutting mode for papillotomy or other needle / wire applications in endoscopy.

ENDO CUT Q 19

For endoscopic polypectomy with a snare. Fractionated cutting and coagulation cycles.

DRY CUT 20

Cutting mode with pronounced hemostasis as a result of voltage control and modulated forms of current.



BIPOLAR PRECISE CUT 21

For exposure and dissection of very fine structures, for example in microsurgery.

BIPOLAR CUT | BIPOLAR CUT+/++ 22

For resection of the prostate, bladder or uterus. Fast arc generation, immediate cutting. Homogeneous, controlled arc generation with low application of energy.

monopolar

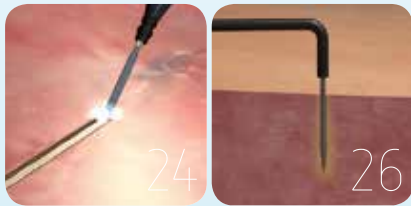
bipolar

COAG



CLASSIC COAG 23

Exposure mode for visceral and cardiac surgery. Exact, layer-specific exposure and dissection. Minimum carbonization of the incision edges.



SWIFT COAG 24

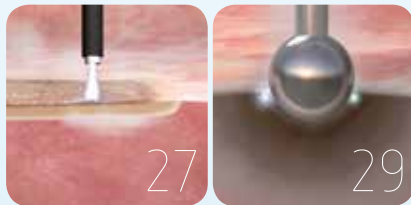
Effective and fast coagulation with pronounced hemostasis that is also suitable for exposure.

TWIN COAG 25

For simultaneous activation of two instruments with only one electrosurgical unit – consistent power output.

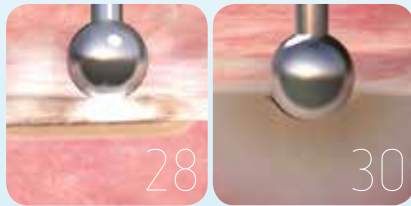
PRECISE COAG 26

For microsurgical coagulation in the lower power range. Precise power settings and effects.



FORCED APC, PULSED APC, PRECISE APC 27

cover the entire spectrum of all types of non-contact APC coagulation. For hemostasis during endoscopy or open surgery or for surface coagulation and devitalization.



SPRAY COAG 28

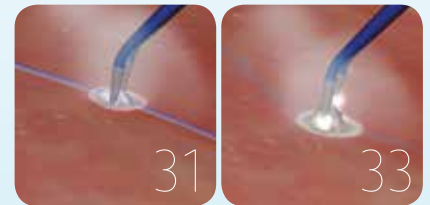
Non-contact and efficient surface coagulation with low thermal penetration. Suitable for tissue devitalization or for stopping diffuse bleeding. Extensive carbonization effects.

FORCED COAG 29

Fast and effective standard coagulation with moderate thermal penetration. Slight carbonization effects.

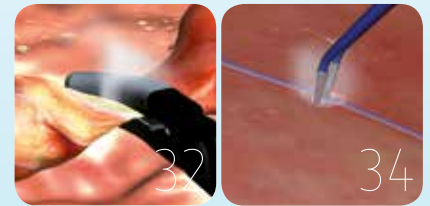
SOFT COAG 30

Gentle coagulation with deep penetration, without carbonization, resulting in minimum adhesion of the electrode. Supported by the power control.



BIPOLAR SOFT COAG 31

Mode for safe coagulation during bipolar resection in saline solution as well as for forceps coagulation.



BICLAMP 32

Supports Erbe BiClamp by providing current for optimum sealing of vessels and tissue structures.

BIPOLAR FORCED COAG 33

Fast, effective, bipolar standard coagulation with moderate hemostasis.

BIPOLAR PRECISE COAG 34

For the exposure and coagulation of very fine structures, for example in microsurgery.

monopolar

bipolar

Instruments



*Monopolar spatula electrode
for open surgery*

35



*Monopolar laparoscopic
hook electrode*

36



*In the bipolar cutting electrode for laparoscopy,
the bipolar current flows
between the needle and the coag cap*

37



*FiAPC probe for flexible
interventional endoscopy*

38

CUTTING INSTRUMENTS

The user can choose between monopolar (see Figure 35+36) and bipolar electrodes as regards cutting instruments (see Figure 37). Bipolar cutting instruments have an active and a passive pole (coag cap). In some laparoscopic instruments the cutting depth can be set with a length-adjustable cutting needle.

DEVITALIZATION INSTRUMENTS

Tissue anomalies in the gastrointestinal and tracheobronchial tract can be devitalized with argon plasma coagulation. An integrated safety filter in the FiAPC probe prevents cross-contamination of the device and probe (see Figure 38).

For more information, refer to:

FiAPC probes leaflet, no. 85100-140



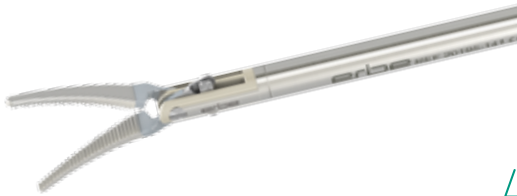
Bipolar forceps for open surgery

39



Monopolar ball electrode for contact and spray coagulation

40



Bipolar laparoscopic forceps

41



Monopolar bronchoscopy probe

42



Bipolar instrument for thermofusion: BiClamp

43

COAGULATION INSTRUMENTS

This overview shows a selection of common monopolar and bipolar coagulation instruments for open surgery (see Figures 39+40), laparoscopic (see Figure 41) and flexible endoscopic (see Figure 42) procedures. High-quality materials are used in order to minimize adhesion of the coagulated tissue on the instrument tip.

The advantages of a non-stick layer for contact procedures:

- ☑ Very little adhesion of the instrument to the coagulated tissue decreases the risk of the vessels being lacerated after coagulation.
- ☑ The full functionality of the electrode remains intact during the procedure, resulting in constant coagulation properties with constant power.
- ☑ Little contamination of the instrument tip improves durability of the instrument.

The surface area and depth extension of the coagulation can be influenced by the type of electrode, type of current and duration of application. The electro-surgical forceps is a "classical" instrument for coagulating vessels and tissue bundles (see Figure 39). The user can choose from various lengths and shapes with different jaw designs.

THERMOFUSION INSTRUMENTS

Thermofusion with the BiClamp reliably seals vessels and tissue – both with open surgery as well as laparoscopic instruments. Neither clips nor sutures are required for vessel diameters up to 7 mm when using individual BiClamp models.

The current type of the VIO system minimizes lateral thermal heating outside of the gripping zone of the jaws. This minimizes the risk of injury to surrounding structures.

BiClamp is available in various lengths and with various jaw shapes, making it very versatile (see Figure 43).

For more information, refer to:

Vessel Sealing leaflet, no. 85100-185

Application

in various disciplines

Electrosurgery is used in many disciplines.

The following application examples showcase the versatility of this surgical technique.



Small access paths during thyroid surgery enable good postoperative cosmetic results



Blood vessels are exposed with the waterjet and can then be coagulated and separated by means of electrocautery

General surgery

THYROID RESECTION WITH BICLAMP

The vessels supplying the thyroid with blood are thermofused with a bipolar clamp (see Figure 44). During this open surgery technique the smallest possible (minimally invasive) access to the vascular structures is created. Generally, the use of clip or suture material to create a ligature of the vessel, which would require more preparation access, can be avoided.

Thermofusion using the BiClamp and a suitable mode of the electrocautery unit minimizes the risk of secondary bleeding.

Advantages at a glance:

- ☑ Minimal lateral damage to surrounding structures
- ☑ The shape of the jaws permits use of small incision techniques, resulting in good post-operative results

LIVER RESECTION

Electrosurgery is used extensively during liver surgery. During liver resection, the incision edges are coagulated using a monopolar scalpel or spatula electrode with the modes AUTO CUT and DRY CUT. Bleeding at the incision edges as well as superficial bleeding of the liver or the liver bed can subsequently be homogeneously coagulated with APC.

Electrosurgery in combination with waterjet surgery

After a partial liver resection using a waterjet applicator (see Figure 45), electrocautery can be used. The vessels of the liver are dissected with electrocautery forceps or with the monopolar electrode. Larger vessels must be treated with a clip or suture.

Additional advantages:

- ☑ Targeted treatment of the blood vessels, little blood loss
- ☑ Shorter operating times



Open surgery dissection

Abdominal surgery

ELECTROSURGICAL DISSECTION

Electrosurgical cutting, coagulation and dissection with the electrocautery pencil and spatula, needle or ball electrodes, for example during general surgery (see Figure 46). Electrosurgery is used when opening the abdomen as well as during dissection of peritoneal tissue.

By selecting the suitable electrode type and using a certain mode of the VIO system, the surgeon can respond flexibly to every surgical requirement. For fine incisions with little hemostasis, needle electrodes and cutting modes such as PRECISE CUT or AUTO CUT are used. Incisions in strongly vascularized tissue require large-area electrodes such as spatula electrodes as well as modes with a pronounced hemostasis effect (AUTO CUT or DRY CUT).

Additional advantages:

- ☑ The VIO modes can be regulated using effect levels
- ☑ Various electrocautery pencils or foot switches allow individual working styles



*The changed mucosa in watermelon stomach;
an indication for APC*



*Safe polypectomy with ENDO CUT:
minimal risk of bleeding and perforation*

Gastroenterology – Flexible endoscopy

APC APPLICATION IN THE GASTROINTESTINAL TRACT

Various settings and modes can be configured on the APC device (such as PULSED APC, FORCED APC) for hemostasis of diffuse bleeding in the esophagus, stomach (see Figure 47) and intestines as well as for devitalization of lesions. APC probe types have various nozzle outlets, enabling punctiform or two-dimensional coagulation zones.

The penetration depth is nearly self-limiting, which is why the risk of perforation is largely excluded.

Additional advantages:

- ☑ Non-contact procedure, no adhesion of coagulated tissue
- ☑ Fast, effective and homogeneous coagulation, also of large-area surfaces
- ☑ Minimal carbonization
- ☑ Minimal smoke generation; good visibility of the operating area

ENDO CUT FOR POLYPECTOMY AND OTHER ENDOSCOPIC RESECTION PROCEDURES (EMR, ESD)

ENDO CUT is a fractionated cutting mode with alternating cutting and coagulation procedures. The combination of voltage regulation and electric arc regulation enables controlled snare resection of polyps with safe, reproducible hemostasis.

After a short preliminary cutting phase that can vary in duration, the actual tissue incision follows. In the subsequent cycle the tissue is coagulated through voltage regulation and prepared for the next cutting cycle. The intensity of the coagulation can be set through four effect levels, whereby the last level represents the maximum coagulation zone at the base of the polyp. The cutting duration can be varied depending on the type of polyp, from slow to fast resection speed.

Using these variable parameters, ENDO CUT can also resect large polyps – without increased risk of intestinal wall perforation on the one hand or a bleeding polyp base on the other hand (see Figure 48).

Advantages at a glance:

- ☑ Safe resection of all types of polyps with safer hemostasis; minimal perforation risk
- ☑ Cutting and coagulation settings are individually programmable



The mucosa is lifted with a waterjet for safe dissection of the mucosal lesion



Thermofusion of the parametrium with the BiClamp

HYBRIDKNIFE FOR RESECTION OF EARLY-STAGE CARCINOMAS

More safety during ESD* and EMR** through waterjet elevation of the mucosa. The separation medium produces a submucosal water pillow and lifts up the mucosal lesion (e.g., an early-stage carcinoma). For resection, this tissue lifting has both a mechanical as well as a thermal protective function (see Figure 49).

The instrument for ESD: HybridKnife with electrosurgery and waterjet surgery function. All four steps – marking of the lesion, elevation, incision/ dissection and coagulation – can take place without changing instruments.

Additional advantages:

- ☑ Resection safety because the separation medium can be subsequently dosed at any time
- ☑ Layer-selective elevation

Gynecology

VAGINAL HYSTERECTOMY WITH THE BICLAMP

The BiClamp is an instrument used for effective thermofusion of vessels and vascularized tissue structures. In gynecology these properties are used to seal uterine tissue structures before separation and mobilization of the uterus during transvaginal hysterectomy.

The cervix and parametrium are reliably thermofused with the bipolar BiClamp procedure so that the surgeon does not need to use sutures or clips to treat the vessels (see Figure 50). All steps can therefore be performed through vaginal access. The BiClamp procedure is also used laparoscopically, for example during laparoscopic hysterectomy, during LAVH, TLH and LASH.

The advantages of the BiClamp procedure at a glance:

- ☑ The anatomically adapted shape of the BiClamp enables a minimally invasive transvaginal procedure
- ☑ Rapid healing process, brief in-patient stay
- ☑ Sutures or clips are usually not necessary due to reliable vascular sealing with BiClamp
- ☑ Low degree of post-operative pain

* Endoscopic submucosal dissection

** Endoscopic mucosal resection



Koagulation von Blutungen, Devitalisierung und Schrumpfung größerer Tumoreale mit APC



Optimale Hämostase bei der TUR mit DRY CUT oder HIGH CUT

Pneumology

APC IN PNEUMOLOGY

The non-contact APC procedure is suitable for hemostasis of superficial bleeding in interventional pneumology (see Figure 51).

Additional indications: Papillomatosis, granulomas, polyps and other tumors, which are also devitalized by APC. Desiccation of the tissue causes a shrinking effect of the lesion with the intent of recanalization of airway stenoses. Can also be used for stent ingrowth/overgrowth.

The relevant properties of APC in pneumology:

- ☑ Non-contact procedure
- ☑ Fast, effective and homogeneous coagulation, also of large-area surfaces
- ☑ Shallow and dosable coagulation penetration depths, minimal risk of perforation
- ☑ Minimal smoke gas generation; good visibility of the operating field

Urology

TRANSURETHRAL RESECTION (TUR) (MONOPOLAR, BIPOLAR) WITH DRY CUT OR HIGH CUT AND BIPOLAR CUT ++

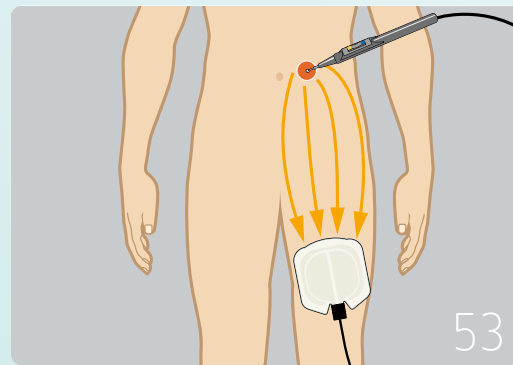
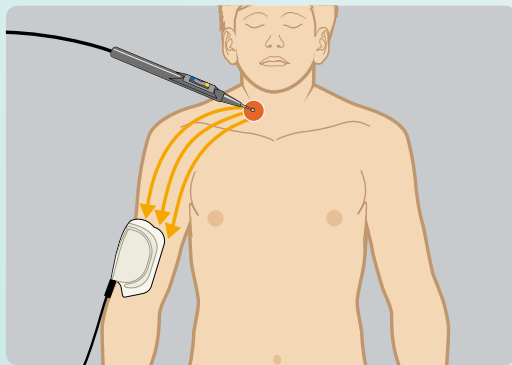
Transurethral resection of the prostate requires a special cutting effect with strong hemostatic properties. DRY CUT or HIGH CUT prevents secondary bleeding thanks to the automatic power dosing (see Figure 52). TUR is performed using either a monopolar or bipolar technique. The BIPOLAR CUT++ mode is suitable for the bipolar technique in conductive irrigating solution.

Additional advantages of TUR electrosurgery:

- ☑ Rapid ablation of even large volumes
- ☑ Irrigating solution remains clear for a long time
- ☑ Low risk of a TUR syndrome

Tips for safe use

During proper use of electrosurgery, risks to the patient and operating staff are minimised. This checklist is intended to make the user aware of risks so that these can be excluded.



The patient plate should be placed as close as possible to the operating area

GENERAL TIPS

- ☑ Before turning on the system, familiarise yourself with its function and proper use (see the Medical Devices Operator Ordinance). In addition to the user manual, Erbe provides training and additional literature for its products
- ☑ Electrosurgical devices, instruments and accessories are often calibrated to each other; you should therefore use equipment made by one manufacturer whenever possible. For more information, refer to the Erbe user manuals
- ☑ Before use, the electrosurgical unit, instruments and accessories should be inspected for correct functioning and any defective areas
- ☑ Avoid small point skin-to-skin contact on the patient (e.g. on the hand/thigh)
- ☑ Connection cables should not touch the patient or other cables and should not create tripping hazards in the OR
- ☑ Do not place instruments on or next to the patient
- ☑ Take care with disinfectants: The alcohol they contain can be ignited by electric arcs

PATIENT POSITIONING

- ☑ The patient should be dry and insulated. If necessary, replace wet operating table overlays or surgical drapes during the operation
- ☑ Use a urine catheter for longer procedures
- ☑ The patient may not touch any electrically conductive objects

OTHER RECOMMENDATIONS

- ☑ **Pregnancy**
Although no events have been reported (e.g. thermal damage to the embryo), we recommend using the bipolar procedure on pregnant women
- ☑ **Simultaneous operation of two electrosurgical units in one patient**
This operating mode can be problematic; we therefore recommend using a device with TWIN COAG function

OPERATIONS ON PACEMAKER PATIENTS

- ☑ Heed the recommendations of the pacemaker manufacturer
- ☑ Prevent current flow through the pacemaker, probe and myocardium
- ☑ The patient plate should be placed as close as possible to the operating area but at a minimum distance of 15 cm from the pacemaker
- ☑ The bipolar technique is preferable to the monopolar technique
- ☑ Select low settings
- ☑ If possible, deactivate the pacemaker or ICD before the HF application
- ☑ The pacemaker should be checked for possible incorrect functioning before, during and after the operation
- ☑ Short activation impulses should be avoided. The pacemaker could interpret these as arrhythmias and deliver stimuli

TIPS FOR PLACEMENT OF THE PATIENT PLATE WITH THE MONOPOLAR TECHNIQUE

With today's state of technology, the risks of monopolar electrosurgery are very low. However, questions and problems do arise in connection with application of the patient plate, which we discuss in this section. In addition to employing care when placing the patient plate with total area contact, we recommend adhering to the following safety checklist:

- ☑ Check the cable and plug for damage
- ☑ Do not cut the patient plate
- ☑ Place the long edge of a split patient plate towards the operating field
- ☑ The application area should be dry and smooth, free of disinfectants, free of body hair and free of wrinkles
- ☑ Air bubbles between the skin and the patient plate should be avoided; do not use contact gel
- ☑ Do not place the patient plate on scarred or inflamed skin, on bony structures or in the vicinity of metal implants
- ☑ Conductive muscle tissue with little electrical resistance is preferred to areas with subcutaneous fatty tissue. We recommend the upper arm or thigh
- ☑ The patient plate should be placed closer to the surgical site than to an ECG electrode – with the greatest possible distance between the patient plate cable and the ECG cable
- ☑ When moving the patient, the correct position of the electrode and connection should be checked again
- ☑ The NESSY patient plate is not suitable for reuse and should be replaced after each removal (e.g., when correcting the position)

General tips:

- ☑ Glove flashovers can occur during monopolar electrosurgery if forceps are activated through a monopolar electrode (improper use!). As this is quite often used in practice, we recommend using insulated forceps
- ☑ ECG disruptions caused by electrosurgery can be prevented by using monitor filter systems or original accessories

Application in children

- ☑ If the upper arm or thigh are too thin, then the patient plate can also be applied to the body
- ☑ Patient plates should generally be applied to the body in infants. Whenever possible, work with a low HF power under 50 W
- ☑ Children's patient plates should only be used in patients on whom larger patient plates cannot be applied. The larger the patient plate, the smaller the thermal heating of the skin

Operations in patients with jewelry (piercings, necklaces, rings, etc.)

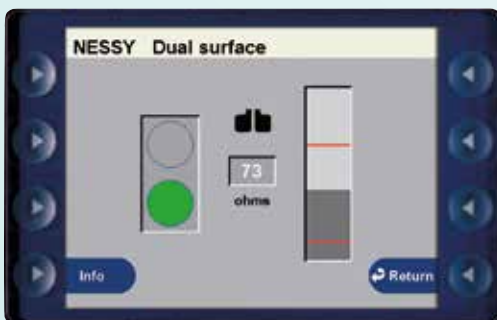
- ☑ As a rule, we recommend that jewelry be removed (piercings, necklaces, rings, etc.)

Using electrosurgery on patients who are wearing jewelry does not, however, constitute a contraindication as long as the following rules are complied with:

- ☑ The jewelry may not come into direct contact with the active electrode or the patient plate
- ☑ The active electrode and patient plate may not be applied in the direct vicinity of the part of the body with the jewelry
- ☑ The part of the body with the jewelry may not be directly between the active electrode and patient plate
- ☑ The jewelry may not come into contact with conductive material

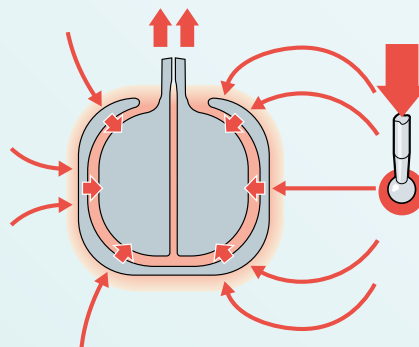
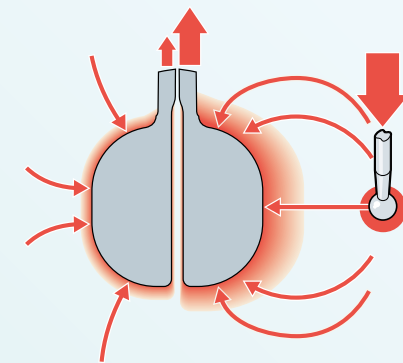
And after the procedure...

- ☑ Carefully remove the patient plate from the skin in order to prevent injury.



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The VIO display shows whether the neutral electrode has been correctly positioned



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↑ Partial heating of the edges of the operating area (leading edge effect)
 ↓ The leading edge effect is avoided by the equipotential ring

SAFETY, THE SYSTEMATIC APPROACH

By selecting the right equipment, safety risks can be reduced to a minimum from the outset. Erbe offers a comprehensive safety package with NESY.

NEUTRAL ELECTRODE SAFETY SYSTEM

The neutral electrode safety system (NESY) integrated in the Erbe VIO system checks the correct, total surface application of a split neutral electrode (patient plate) and continuously compares the currents that flow through both surfaces of the NE (see Figure 54). A varying distribution of the currents indicates that the NE has not been applied correctly. There is a risk of a partially high current density and tissue heating.

Activation is possible with slight deviations. In the event of larger discrepancies, NESY issues a warning signal and interrupts activation (display: red light). In order to prevent thermal necroses, the NE can only be activated again after correct application.

EASY AND SAFE APPLICATION WITH NESY Ω

The neutral electrode NESY Ω simplifies positioning. The outer, uncontacted equipotential ring of NESY Ω allows you to position the neutral electrode independent of the direction. Current is equally distributed on the inner contact areas and no "leading edge effect" occurs (see Figure 55 ↑). The contact area is smaller than with conventional electrodes. This makes it easier to place on the patient's body (see Figure 55 ↓). NESY Ω is used universally for children and adults.

We recommend using NESY Ω for a high degree of safety in monopolar electrosurgery.

For more information, refer to:
 NESY brochure, no. 85800-107



Glossary

Active electrode

The part of the electrosurgical instrument that transmits the electrosurgical current at the site of the intended tissue effect to the patient's tissue; acronym: AE

Argon plasma coagulation

Monopolar, non-contact coagulation. Electrically conductive argon (argon plasma) transmits the current to the tissue through electric arcs. Acronym: APC

Bipolar electrosurgery

Electrosurgical procedure in which both electrodes are integrated in an instrument

Burns due to patient plate

Burning of the skin due to excessively high heat generation through excessive current density under or at the patient plate

Carbonization

Carbonization of biological tissue

Coagulation

1. Denaturation of proteins. 2. Electrosurgical effect during which proteins coagulate and the tissue shrinks

Current density

Current flow amount per cross-section area. The higher the current density, the more heat is generated

Cutting

Electrosurgical effect during which the intracellular fluid is explosively vaporized and the cell walls burst

Desiccation

Drying out of biological tissue

Devitalization

Killing off of biological tissue

Diathermy

Synonym for electrosurgery

Electric arc

Electrical discharge in the form of a diminutive flash

Electrode

Conductor that transmits or receives current, e.g. active electrode, patient plate

Electrosurgery

Use of high-frequency electric current on biological tissue with the goal of creating a surgical effect through heating. Synonyms: HF surgery, diathermy, radio frequency (RF) surgery

Frequency

Rate of periods per second during which the current direction changes twice, for example. Unit: hertz (Hz). 1 kHz = 1,000 Hz

Hemostasis

Stopping of blood flow

High frequency

In terms of electrosurgery (standard: IEC 60601-2-2): frequency of at least 200 kHz. Acronym: HF; also radio frequency (RF)

High-frequency generator

Device or device component that converts direct current or low-frequency alternating current into high-frequency surgical current

Incision quality

The nature of the incision, especially the extent of the coagulation at the incision margin. The desired incision quality depends on the application

Lesion

Damage, injury or disruption to an anatomical structure or physiological function

Monopolar electrosurgery

Electrosurgical procedure during which the active electrode is used at the surgical site and the electrical circuit is closed by a patient plate

Necrosis

Pathological cell death

Patient plate

Conductive electrode which is attached to the patient during a monopolar application in order to receive the HF current. It feeds the current back to the electrosurgical unit in order to close the electrical circuit. Synonyms: neutral electrode, return electrode

Power

Energy per second. The electrical power is the product of current and voltage. Unit: watt (W)

Thermofusion

Fusion of tissue through coagulation

Vaporization

Vaporization of tissue



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