Abstract of the S1-Guideline: Intermittend pneumatic compression (IPK, AIK)

S. Reich-Schupke; C. Schwahn-Schreiber

On behalf of the group of authors of the Guideline: Dr. Franz-Xaver Breu, Prof. Dr. Eberhard Rabe, Prof. Dr. Ivo Buschmann, Dr. Walter Döller, Prof. Dr. Gerd Lulay, Dr. Anya Miller, PD Dr. Eva Valesky

Keywords
Compression, congestion, edema, perfusion

Summary
The intermittend pneumatic compression (IPK, AIK) consists of prophylactic or therapeutic use of alternating pressure for prophylaxis of thrombosis, treatment of edema, improvement of arterial and venous perfusion with reduction of clinical symptoms and improvement of wound healing. IPK can be used in an in- and outpatient setting as well as a home treatment after education of the patient. The equipment consists of a generator and additional cuffs. The devices differ according to indication, localisation of treatment and technical parameters. With correct use and indication, IPK is an effective and safe treatment option. Adverse events are very rare. There is an urgent need for methodical well conducted studies in different indications – except prophylaxis of venous thromboembolia. The protocols should list exact data on the used device (compression and cuffs) and technical parameters (inflation, deflation, plateau, time of break, use per day or week, duration of use).

Schlüsselwörter
Kompression, Ödem, Entstauung, Perfusion

Zusammenfassung
Die Intermittierende pneumatische Kompressionstherapie (IPK, AIK) besteht in der prophylaktischen und therapeutischen Anwendung von pneumatischen Wechseldrücken zur Thromboembolieprophylaxe, Entstauungstherapie bei Ödemerkrankungen, Verbesserung der arteriellen und venösen Durchblutung mit Reduktion der klinischen Symptome sowie zur Förderung der Wundheilung. Die Therapie kann sowohl stationär als auch ambulant in einer medizinischen Einrichtung oder – nach entsprechender Schulung – als Heimtherapie angewendet werden. Die Geräte bestehen aus Generator und Manschetten und unterscheiden sich abhängig von ihrer Indikation und der Ziellokalisation im Aufbau sowie in den technischen Parametern der Therapie. Bei richtiger Indikationsstellung und Anwendung handelt es sich um eine effektive und sichere Therapiemethode. Unerwünschte Ereignisse treten extrem selten auf. Es besteht ein dringender Bedarf an methodisch gut gemachten Studien zur IPK in verschiedenen Indikationen (Ausnahme VTE-Prophylaxe, gute Evidenz). In den Protokollen sollten zwingend genaue Angaben zum verwendeten Gerät (Kompression und Manschette) sowie zum Behandlungsprotokoll (Inflation, Deflation, Plateau, Pausenzeiten, Behandlungsfrequenz pro Tag oder Woche sowie zur Gesamtdauer der Anwendung) gemacht werden.

Correspondence to:
Prof. Dr. Stefanie Reich-Schupke
Klinik für Dermatologie, Venerologie und Allergologie
Venenzentrum der Dermatologischen und Gefäßchirurgischen Kliniken
Stiftungsprofessur Phlebologie
Gudrunstr. 56
44791 Bochum
Tel. 0234–8792–377 / –274
E-Mail: Stefanie.Reich-Schupke@rub.de

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Important note!

The current manuscript is a summary of the important recommendations of the guideline. It is NOT the complete version that can be found online at https://www.awmf.org/uploads/tx_szleitlinien/037–007l_S1_Intermittierende-pneumatische-Kompression-IPK-AIK_2018–05.pdf (accessed 03.07.2018) and can be cited as Schwahn-Schreiber, C., Breu, F.X., Rabe, E. et al. S1 Guideline on Intermittent Pneumatic Compression (IPK, AIK). Hautarzt (2018). (https://doi.org/10.1007/s00105–018–4219–1 (https://link.springer.com/article/10.1007/s00105–018–4219–1; accessed 03.07.2018). The list of references can also be found the stated sources.

Introduction

The guideline was edited by a committee of experts consisting of members of various specialist societies with the aim of optimising patient selection and the therapeutic use of IPC in venous diseases and oedema. The statements and recommendations were compiled after intensive literature searches and represent an expert consen-

Tab. 1 Indications for IPC

IPC must be undertaken in the following indications:
- Thromboembolism prophylaxis, if no pharmacological prophylaxis is possible

IPC is advisable in the following indications:
- Venous leg ulcers refractory to consistent compression therapy with stockings or compression bandages
- Severe chronic venous insufficiency Stage C4b to C6 (CEAP classification)
- Lymphoedema of the extremities, as an adjunct to complex physical decongestion therapy if this achieves no compensation
- Peripheral arterial occlusive disease (PAOD) with stable intermittent claudication or critical ischaemia, if a supervised exercise programme is not possible and interventional or surgical reconstruction is not feasible

IPC is a treatment option in the following indications:
- Post-traumatic oedema
- Treatment-resistant venous-induced oedema
- Lipoedema
- Lymphoedema of the extremities, as an adjunct to complex physical decongestion therapy
- Hemiplegia with sensory disorder and oedema
- Thromboembolism prophylaxis in addition to pharmacological prophylaxis

Tab. 2 Contraindications to IPC

- IPC must not be carried out in the presence of an absolute contraindication.
- If a relative contraindication is present, IPC can be undertaken under close clinical monitoring and with appropriate precautions (see side effects).

The following **absolute contraindications** must be observed:
- Decompensated heart failure
- Extensive thrombophlebitis, thrombosis or suspected thrombosis
- Acute erysipelas
- Acute phlegmon
- Compartment syndrome
- Severe, uncontrolled hypertension
- In addition, IPC must not be undertaken if lymphatic drainage is occluded, where congestion in the inguinal or genital regions has occurred under IPC,

The following **relative contraindications** should be observed:
- Extensive, possibly open soft tissue trauma of the extremities
- Marked neuropathy of the extremities
- Bullous skin diseases such as IgA dermatitis or pemphigoid

Tab. 3 To avoid side effects and complications it is recommended that:

- Textile skin protection is used under the plastic sleeve and regular inspections and care of the skin are carried out to prevent skin damage.
- Padding over vulnerable sites is used to prevent nerve damage and pressure ulcers, especially in thin or cachexic patients.
- Genital lymphoedema has not been described or explicitly denied in any study since 1998 and this possibility should be considered. If oedema increases in the pelvic or genital area during IPC for lymphoedema, IPC should be discontinued and the diagnostic workup regarding drainage obstruction extended or repeated.

sus. In those areas of the subject where the literature offered little material, the recommendations were based on the experiences of everyday clinical practice. The published guidelines on thromboembolism prophylaxis, on lymphoedema and on lipoedema also contain some sections about IPC and these should be noted as well.

Definition and action

The principle of IPC is the prophylactic and therapeutic use of alternating pneumatic pressures for thromboembolism prophylaxis, for decongestive therapy in oedema, to improve arterial and venous blood flow with a consequent reduction in clinical symptoms and to promote wound healing. The treatment can take place either on an inpatient or outpatient basis in a medical setting – or, after appropriate training – as domiciliary therapy. The devices used differ depending on the indication and target site.

IPC has many actions, including haemodynamic, haematological and fibrinolytic effects. It also influences oxygen tension in the tissues and reduces oedema.

Indications and contraindications

Recommendations for the use of IPC in ▶ Table 1 correspond to the studies currently available. Use of IPC requires a precise prior diagnosis, and possible contraindications must be considered before and during the course of treatment (▶ Table 2).

Risks and side effects

Based on the current data, with only a few case reports and a retrospective recording of relevant side effects and complications, IPC can be assessed as effective and safe (▶ Table 3). The reported skin damage mainly occurred after several days of continuous use of IPC as part of DVT prophylaxis. Skin lesions, folliculitis and blistering, predominantly in fragile-skinned elderly patients, were described and soft tissue damage occurred when IPC was not applied correctly. Nerve damage, pressure ulcers and very rarely a compartment syndrome or pulmonary embolism have also been reported. Genital lymphoedema was observed in an older, retrospective study, but over the past 15 years neither this nor fibrotic rings of inguinal tissue have been reported, or been explicitly denied. Nevertheless, the possibility should be considered. If the skin is particularly sensitive, e.g. in severe congestive dermatitis or lymphocutaneous fistulae, until the skin has stabilised IPC should only be undertaken under antibiotic cover.

Patient information

As with all other forms of therapy, patients are to be thoroughly informed about the benefits and risks of IPC and the alternative treatment options. It is recommended that this information and explanation, as well as the consent or refusal of the patient, is documented.

According to current data, IPC is not an unavoidable, sole or urgently necessary measure in any indication, but has considerable positive effects in some areas of use. Accordingly, the refusal of the patient to undergo this treatment, or a conscious/justified medical abstention from carrying

Tab. 4 Summary of recommendations for the use of IPC in the various indications

Indication	Recommendations
Thromboembolism prophylaxis (The recommendations on thrombosis prophylaxis are based on the S3 guideline: Prophylaxis of deep vein thrombosis (DVT) and are shown here for a better overview of the subject and for completeness. The following core recommendations have been adopted from this guideline)	• In patients with a moderate or high risk of DVT, basic measures should be used alongside pharmacological prophylaxis. • In addition, physical measures may be applied. • Basic as well as physical measures should not replace pharmacological DVT prophylaxis, where this is indicated. • Conversely, when pharmacological DVT prophylaxis is used, basic measures should not be ignored and physical measures applied where appropriate for the indication. • If pharmacological DVT prophylaxis is contraindicated, physical measures should be used. • It appears sensible for every hospital to have some IPC devices available, so that the technique can be provided for patients with high risk of DVT and contraindications to pharmacological prophylaxis.
Chronic venous insufficiency with or without venous leg ulcer	• IPC can be used in patients with CVI to improve chronic venous symptoms and the quality of life. • IPC can be used as domiciliary therapy in patients with CVI. • In CVI with no venous leg ulcer, IPC can be used at pressures of 30–40 mmHg, an inflation of 15s and a deflation of 10s with multilevel sleeves and a distal to proximal build-up of pressure. • To promote wound healing in patients whose venous leg ulcers show no tendency to heal under standard therapy, IPC (leg) should be used with multilevel sleeves (sequential pressure build-up, target pressure 40 – 50 mmHg) at least 1 hour per day, at least 3 x per week.
Post-traumatic oedema	• IPC can be used in patients with post-traumatic oedema. It reduces the oedema and, when applied preoperatively, reduces the rate of infection and improves soft tissue healing and pain.
Lymphoedema	• IPC can be an adjuvant form of treatment to complex physical decongestion therapy (CPDT), especially for predominantly distal arm or leg oedema not involving the ipsilateral trunk quadrants and if patient mobility is limited. • IPC should be used additively for lymphoedema not compensated under CPDT. • IPC can be used as domiciliary treatment in patients with lymphoedema, but monitoring by a physician must be guaranteed. • Multilevel devices to treat lymphoedema, with compression pressures of up to 120 mmHg depending on the tissue condition, should be used on the leg and pressures of up to 40 mmHg on the arm. Longer inflation and deflation times (each around 50 s) and a sequential build-up of pressure should be chosen.
Lipoedema	• IPC can be used in lipoedema patients to reduce the oedema, relieve pain and decrease the tendency to bruise – also as domiciliary therapy.
PAOD	• The indication for IPC should be examined in PAOD with stable intermittent claudication or critical ischaemia. However IPC should only be used if interventional or surgical reconstruction is not feasible and a supervised exercise programme is not possible. • In PAOD, IPC should be carried out with foot and calf sleeves, target-adjusted pressures of 85 – 120 mmHg, short inflation time, 3 cycles per minute and daily use. • IPC can be used to reduce postoperative oedema after surgical reconstruction in PAOD.
Diabetic foot lesion	• No firm recommendation in the absence of data.
Hemiplegia with sensory deficit and oedema	• IPC can be used to improve a sensory deficit in hemiplegic patients.

out this additive measure, is to be documented in writing.

Legal basis, standards and prescriptions

IPC devices are listed as "Aids for compression therapy" in Product Group 17 of the Medical Aids Register (date 9/2015) and are allotted a multi-digit position number. They can therefore be prescribed and are reimbursed by health insurance schemes. Different devices are available for hospitals, medical practices and domiciliary use. To date, devices have not been standardised and no such process is planned at present.

The devices for IPC can be used in a hospital or an outpatient medical setting. In addition, domiciliary devices are a worthwhile approach, especially in chronic indications (e.g. PAOD, lymphoedema, CVI) and they promote the self-management and independence of the patient.

Efficacy must be demonstrated before a domiciliary device is prescribed (test phase in hospital or practice under medical supervision) and appropriate training in handling the device must be given to the patient and/or relatives. Regular medical monitoring should also take place in the phase of domiciliary use and the patient must be given clear instructions by a doctor about the key data of the treatment: duration per day, frequency of use per week or per day, overall duration of use, pressure setting and necessary protection measures to avoid potential side effects.

Devices

IPC devices usually consist of 2 components – a controller and the sleeves, but there is great variation in the many different types of device in clinical use, that differ with respect to the type of compressors and sleeves.

The controller is a Group IIa medical device and determines the course of treatment – pressure build-up (intermittent/sequential), pressure hold phase, release phase, pause times and cycle repetition.

Sleeves differ in the number and arrangement of their compartments (single-chamber/multi-chamber, overlapping/not overlapping) and in the way in which these are filled (simultaneously or consecutively). The sleeves also differ depending on the site of application – foot or foot and lower leg sleeves (a special shoe with inflatable soles and sometimes also calf sleeves), extremity sleeves (legs or arms) as well as trouser and jacket pumps that apply pressure to the extremity or trunk using double-walled treatment sleeves.

There is often confusion between the terms "multilevel" and "multi-chamber (segmented)" devices. The treatment options of the device to achieve a different number of pressure levels are determined by the controller setting and not the number of chambers in the attached sleeve. The term "multilevel devices" should therefore be given priority.

Use of IPC according to indications

The treatment protocol used with IPC (which device, components, treatment cycle, treatment frequency) varies considerably, depending on the indication, target vascular system and target tissues (lipoedema, thrombosis prophylaxis, lymphoedema, PAOD) and tissue condition. Only a few studies on the controlled comparison of different device types and treatment protocols have been published. The following recommendations for IPC are based on the literature and the expert consensus (▶ Table 4).

Conclusions for routine practice

Due to a wide variation in devices and treatment protocols, the present data on the various indications is very heterogeneous. Nevertheless, based on the available literature, when applied correctly in suitable patients – also when used additively – IPC is an effective and safe form of therapy, particularly in the treatment of various vascular diseases and oedema, wound healing and also in PAOD therapy. This is despite the fact that only RCTs with generally limited evidence are available and the recommendations are sometimes also empirical.

Conflict of interest

S. Reich-Schupke: Fees for lecture and training activities of Medi, Sigvaris, Juzo und Ofa; C. Schwahn-Schreiber: Fees for lecture and training activities of Sigvaris, medi und Lymphologic

Ethical guidelines

No studies in humans or animals were conducted for the manuscript.

References

The list of references can be found in the full version of the guideline available from the above-mentioned sources.