ORIGINAL RESEARCH

Graduated compression therapy usage among surgeons in the COSECSA region: A cross-sectional study

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Abstract

Background
Numerous studies have demonstrated that graduated compression therapy (GCT) is efficacious in the management of venous disorders, as well as in the prevention of venous thromboembolism (VTE).
This study aimed to delineate GCT usage by surgeons in the region served by the College of Surgeons of East Central and Southern Africa (COSECSA).

Methods
We conducted a cross-sectional study among surgeons attending the 17th COSECSA Annual Scientific Conference in Mombasa, Kenya, between 7 and 10 December 2016. Only surgeons practising in the COSECSA region were included. Participation was voluntary, and those who consented were asked to complete a pretested questionnaire.

Results
Ninety-four surgeons of various specialities submitted complete questionnaires. General and orthopaedic surgeons (48% and 30% of respondents, respectively) saw the most patients with venous disorders and patients at risk of VTE. Considering the mean number of patients seen, respondents prescribed GCT infrequently. Orthopaedic surgeons were the least likely to report having prescribed GCT for patients who might have benefited from such therapy, only doing so 15% of the time. The commonest indications for GCT prescription were varicose veins and VTE prophylaxis. The most commonly reported challenge was availability. No respondent reported experience with serious adverse events associated with GCT, such as limb ischaemia or nerve injury. A majority of the surgeons (58%) reported that GCT is effective for the prevention of VTE as well as the treatment of various venous disorders.

Conclusions
GCT is widely accepted as a useful tool in the prevention of VTE and management of various venous disorders among surgeons in the COSECSA region. However, GCT usage is low, owing to challenges such as availability.

Keywords: graduated compression therapy, compression stockings, venous insufficiency, venous thromboembolism, deep vein thrombosis, varicose veins, Africa

Introduction

The earliest documented use of external compression for the treatment of venous disease is from the times of Hippocrates.[1] In 1931, Wright documented the first successful use of external compression for the treatment of chronic venous insufficiency.[2] At that time, compression therapy involved uniform compression with simple wraps. The amount of pressure applied varied from device to device and from individual to individual.

Compression therapy devices have since evolved to the present-day graduated compression stockings that apply a known amount of pressure that is maximal at the ankle and gradually reduces as you move up the garment—graduated pressure from distal to proximal.[3]

The pressure gradient created by graduated compression stockings has the effect of reducing the diameter of major veins and, therefore, increasing the velocity and volume of blood flow in these veins. This results in a reduction of ve-

nous reflux and venous hypertension, as well as improved venous and lymphatic drainage.[4,5]

The Kenyan national guidelines on the management of venous disorders are brief and do not mention GCT as an option for the treatment of venous disorders[6]; there exist no locally adapted guidelines for thromboprophylaxis. Some authors have raised concern over the adoption of guidelines developed elsewhere and have indicated the need for the development of locally adapted guidelines for the prevention of DVT/VTE.[7]

This state of affairs leaves the use of GCT more at the discretion of individual surgeons or physicians with no protocol guiding their usage. The specific patterns and extent of GCT use by surgeons in the region are not known, and this study sought to rectify this.

The objective of the study was to describe the practice of GCT among surgeons of different specialities in the region served by the College of Surgeons of East Central and Southern Africa (COSECSA). Specifically, we sought to establish how frequently surgeons of different specialities prescribe GCT, the common indications for which GCT is prescribed, and the encountered benefits and challenges associated with GCT use in the region.

Methods

We conducted a cross-sectional observational study at the 17th COSECSA Annual Scientific Conference held in Mombasa, Kenya, between 7 and 10 December 2016. The conference provided a forum where a large number of surgeons from the region could be accessed within a short period.

All consenting surgeons attending this conference were recruited into the study. Surgeons practising outside the COSECSA region were excluded. Participation was voluntary.

A pretested questionnaire covering various aspects of the use of GCT was administered to all participating surgeons.

Responses to closed-ended questions were coded and analysed using SPSS version 24 (IBM Corp., Armonk, NY, USA). Responses to open-ended questions were categorized and analysed manually by 2 independent analysts who subsequently compared their results and arrived at a consensus decision.

Results

Ninety-four surgeons of different specialities were interviewed. Nearly half of them (48%) were general surgeons, and almost a third (30%) were orthopaedic surgeons, reflecting the large proportion that these 2 specialities contribute to the overall number of surgeons in the region. Other specialities were also represented as indicated in Table 1.

We asked the surgeons how often they managed patients with different venous disorders and received the responses summarized in Table 2. With a mean of 188 patients seen annually, cardiothoracic and vascular surgeons reported seeing the highest number of patients with venous disorders. Paediatric surgeons reported that they did not manage patients with venous disorders.

Table 1. Specialities of surgeon respondents at the 17th COSECSA Annual General Meeting and Scientific Conference

Speciality	n	%
General	45	47.9
Orthopaedic	28	29.8
Urology	6	6.4
Plastic and reconstructive	4	4.3
Cardiothoracic and vascular	3	3.2
Neurosurgery	3	3.2
Paediatric	3	3.2
Breast and endocrine	2	2.0
TOTAL	**94**	**100**

We also established how often the surgeons attended to patients with DVT/VTE or who were at risk of the same. Again, the cardiothoracic and vascular surgeons saw more patients (mean = 213) than surgeons of the other specialities. The 2 neurosurgeons reported seeing a mean of 208 patients per year, while the breast and endocrine surgeons, orthopaedic surgeons, and general surgeons reported having, respectively, 183, 157, and 140 patient visits per year. Table 2 summarizes yearly DVT/VTE consultation frequencies, as reported by surgeons of different specialities.

We asked the surgeons to estimate how many times they prescribed GCT to their patients, either for thromboprophylaxis or the treatment of venous disorders. The breast and endocrine surgeons reported the highest mean number of yearly prescriptions (188), followed by the cardiothoracic and vascular surgeons, who reported a mean of 111 yearly GCT prescriptions.

The most commonly reported indications for which the surgeons of all specialities prescribed GCT were: the treatment of varicose veins (n = 53), followed by VTE prophylaxis (n = 46) and chronic venous disease or insufficiency (n = 45) (Table 3). General surgeons (n = 32) constituted the largest group prescribing GCT for the treatment of varicose veins. They also accounted for the largest number of surgeons prescribing GCT for the treatment of chronic venous disease or insufficiency (n = 25) and VTE prophylaxis (n = 21).

Eight surgeons listed other indications other than those given above. When these were categorized, they fell into 2 groups: after high-risk surgery (as reported by 7 surgeons) and after stripping of varicose veins (reported by 1 surgeon). Examples of high-risk surgeries listed by the 7 surgeons were surgical procedures that lasted more than 3 hours, spinal surgery, and total knee arthroplasty.

Respondents were also asked to indicate the commonest indication for which they prescribed GCT. Most general surgeons reported that they prescribed GCT for the treatment of varicose veins. Prophylaxis against DVT/VTE was reported to be the most frequent indication for GCT by the orthopaedic surgeons, and venous ulceration was the commonest indication listed by plastic and reconstructive surgeons (Table 4).

Table 2. Reported number of yearly at-risk patients seen and number of compression therapy prescriptions, by speciality

Speciality	Number of yearly consultations for patients with venous disorders		Number of yearly consultations for patients at risk of deep vein thrombosis/venous thromboembolism		Number of yearly prescriptions administered for graduate compression therapy	
	Range	Mean	Range	Mean	Range	Mean
General	0 to 120	25.9	0 to 365	139.5	0 to 364	55
Orthopaedic	0 to 260	37.9	0 to 260	156.7	0 to 104	29
Urology	0 to 12	2.6	0 to 260	77.6	0 to 130	21
Plastic and reconstructive	24 to 52	40	12 to 156	71..0	12 to 52	31
Cardiothoracic and vascular	48 to 260	188	120 to 260	213.3	24 to 260	111
Neurosurgery	–	2	156 to 260	208.0	1 to 260	87
Paediatric	–	0	–	0	–	1
Breast and endocrine	0 to 12	6	2 to 364	183.0	12 to 364	188

Table 3. Reported indications for graduated compression therapy prescriptions, by speciality

Speciality	Frequency						
	Chronic venous disease/ insufficiency	Varicose veins	Post-traumatic/ surgical oedema	Lymphoedema	Prophylaxis of venous thromboembolism	Superficial thrombophlebitis	Venous ulcers
General	25	32	14	21	21	4	17
Orthopaedic	12	14	13	6	17	1	2
Urology	1	0	0	0	3	0	0
Plastic and reconstructive	3	2	2	4	1	0	3
Cardiothoracic and vascular	3	2	0	2	2	0	1
Neurosurgery	1	1	2	0	1	0	1
Paediatric	0	1	1	0	0	0	0
Breast and endocrine	0	1	0	0	1	0	0
Total	**45**	**53**	**32**	**33**	**46**	**5**	**24**

Table 4. Commonest indications for graduated compression therapy prescriptions, by speciality

Speciality	Commonest indication	Second commonest indication
General	Varicose veins	Venous thromboembolism prophlyaxis
Orthopaedic	Venous thromboembolism prophlyaxis	Post-traumatic/surgical oedema
Urology	Venous thromboembolism prophlyaxis	Other
Plastic and reconstructive	Venous ulcers	Lymphoedema
Cardiothoracic and vascular	Chronic venous insufficiency	Varicose veins
Neurosurgery	Venous thromboembolism prophlyaxis	Post-traumatic/surgical oedema
Paediatric	–	–
Breast and endocrine	Varicose veins	Venous thromboembolism prophlyaxis

Table 5. Reported challenges associated with graduated compression therapy, by speciality

Speciality	Frequency					
	Availability	Cost	Aesthetic quality	Patient compliance	Quality	Comfort
General	25	19	3	15	5	10
Orthopaedic	17	16	3	11	4	7
Urology	4	4	1	2	2	1
Plastic and reconstructive	3	3	0	2	1	0
Cardiothoracic and vascular	2	1	0	1	2	1
Neurosurgery	2	2	0	0	2	0
Paediatric	1	2	0	0	1	1
Breast and endocrine	0	2	1	2	0	1
Total	**30**	**10**	**7**	**5**	**17**	**2**

Table 6. Reported benefits associated with graduated compression therapy, by speciality

Speciality	Frequency				
	Effective prophylaxis of venous thromboembolism	Effective management of venous disorders	Decreased limb swelling	Heals venous ulcers	Decreased pain
General	11	3	2	4	–
Orthopaedic	9	4	3	1	2
Urology	3	0	–	–	–
Plastic and reconstructive	–	1	1	–	–
Cardiothoracic and vascular	2	2	1	–	–
Neurosurgery	3	–	–	–	–
Paediatric	-	–	–	–	–
Breast and endocrine	2	–	–	-	–
Total	**30**	**10**	**7**	**5**	**2**

We asked the surgeons what challenges they faced when using GCT. The challenges that were cited by the most surgeons were availability (n = 54), cost (n = 49) and noncompliance (n = 33) (Table 5).

Six surgeons listed challenges other than those given above. When these were categorized, one listed heat as a challenge, and this was considered to fall under the *comfort* category and added to the tally of those who listed comfort as a challenge. Three surgeons indicated "limited knowledge about GCT" as a challenge. One surgeon listed "size" as a challenge, and another one indicated that "folding and creasing" was a challenge they faced related to the use of GCT.

Fifty-four surgeons responded to an open-ended question asking them to comment on the benefits that they and their patients have experienced or realized related to GCT. Their responses were analysed and categorized and are shown in Table 6. Aside from the benefits listed in Table 6, four surgeons indicated low cost as a benefit of GCT.

Discussion

Close to half (48%) of the surgeons interviewed were general surgeons while almost a third (30%) were orthopaedic surgeons. This is indicative of the large proportion that these 2 specialities contribute to the total number of surgeons in the region. The remaining 22% was distributed among 6 specialities. Additionally, even though the 3 cardiothoracic and vascular surgeons conducted more consultations for patients who might benefit from GCT (a mean of 188 yearly patient visits, or 564 total consultations), the general surgeons and orthopaedic surgeons saw more total patients with venous disorders (1113 and 985, respectively). It follows, then, that in COSECSA countries, general surgeons and orthopaedic surgeons likely manage the bulk of patients with venous disorders and those at risk of VTE. For that reason, initiatives targeting improvement of the care offered to these patients should always include these 2 specialities, even though the

bulk of such patients might be treated by plastic and reconstructive surgeons or cardiovascular and vascular surgeons in developed countries.

The 2 pediatric surgeons who responded reported not managing any patients with venous disorders, which points to the rarity of venous disorders in children. They also indicated that they did not manage any patients at risk of DVT/VTE. Though rare, DVT/VTE has been documented in paediatric patients.[8]

Compared to other venous disorders, DVT/VTE was the most frequently reported diagnosis managed by study participants. This finding suggests that emphasis should be made on the use of GCT for thromboprophylaxis when conducting continuous medical education for surgeons in the region.

There was some consensus on the usefulness of GCT across the different specialities, as surgeons of all adult care specialities reported prescribing GCT. Cardiothoracic and vascular surgeons prescribed the highest number of graduated compression stockings per surgeon, with a reported yearly mean of 111 prescriptions.

Except for the breast and endocrine surgeons, respondents from all specialities prescribed GCT much less than might be expected, given the reported burden and risk of peripheral venous disease. For example, the general surgeons saw a yearly mean of 26 patients with venous disorders and 140 patients at risk of DVT/VTE but only prescribed graduated compression stockings 55 times per surgeon. General surgeons, therefore, only prescribed GCT to about one-third of patients who may have benefitted from such therapy. For orthopaedic surgeons, who reported a yearly mean of 195 consultations for patients at risk of VTE or diagnosed with peripheral venous disorders, the mean number of GCT prescriptions per year was 29, representing 15% of patients for whom GCT might have been indicated. This usage rate is lower than what has been reported in other studies. Ziaja and colleagues reported that close to 50% of patients who would have benefited from GCT did not receive it.[9] Even if one argues that not all the patients at risk of VTE eventually require graduated compression stockings, the prescription numbers revealed by this study seem vastly insufficient.

The breast and endocrine surgeons had the highest prescription rate, with a reported per-surgeon mean of 188 yearly prescriptions and 189 yearly visits by patients at risk of VTE or diagnosed with peripheral venous diseases. This may have occurred by chance, as the number of breast and endocrine surgeons (n = 2) was too small to be considered representative of the regional practice in this speciality. A study involving more breast and endocrine surgeons is recommended to establish whether practice in this speciality is truly different from that in the other specialities.

As the body of knowledge in the fields of phlebology and lymphology has grown, graduated compression stocking usage has increased, with stockings offering different compressive pressures being utilized for different indications. In general, low-level compression stockings (10–30 mmHg; Class 1 and Class 2) are indicated for the treatment of chronic venous insufficiency, varicose veins, leg oedema (post-traumatic and post-surgical), superficial thrombophlebitis, and telangiectasia, as well as for the prevention of deep vein thrombosis (DVT). On the other hand, stockings offering compressions higher than 30 mmHg (Class 3) are effective for the treatment of venous ulcers, the post-thrombotic syndrome, as well as lymphoedema.[10,11]

Other less common indications are occupational leg swelling and as an adjunct in the treatment of cellulitis.[12,13]

Graduated compression stocking use for the above indications is backed by numerous studies that have demonstrated the efficacy of graduated compression therapy (GCT) for each specific indication.[4,14–26] Additionally, various guidelines endorse their use for specific indications.[11,15,27]

Locally, a published study showed that GCT as an adjunct in lower limb cellulitis management led to faster resolution of pain and swelling.[13]

In our study, the most frequent indications for which the surgeons of all specialities prescribed GCT were for the treatment of varicose veins (n = 53), followed by VTE prophylaxis (n = 46) and chronic venous disease or insufficiency (n = 45). This suggests that varicose veins may be the venous disorder most frequently encountered by surgeons in the COSECSA region.

The most common indication differed from speciality to speciality. This is most likely due to the different patient groups attended to by surgeons of different specialities. General surgeons most commonly prescribed GCT for varicose veins, suggesting that general surgeons see the majority of patients with varicose veins. Orthopaedic surgeons prescribed GCT mainly for VTE prophylaxis, most likely because of the higher risk of VTE reported among orthopaedic patients. Post-traumatic or surgical oedema was the second most frequent indication for GCT prescriptions by orthopaedic surgeons, suggesting that they encounter this problem commonly in their practice. Urologists and neurosurgeons prescribed GCT for VTE prophylaxis probably because a significant part of their practice involves management of patients with malignancies which are a risk factor for VTE. Plastic and reconstructive surgeons most commonly used GCT for venous ulcers, followed by lymphoedema, suggesting that they may be entrusted with the care of more patients with these 2 conditions than surgeons of the other specialities. Overall, these differences should be kept in mind when providing support, such as continuous medical education, to the groups of surgeons of the different specialities.

Several challenges have been associated with the use of graduated compression stockings. The most frequently cited challenge is poor compliance.[9,28,29] For instance, in a study involving 3144 new chronic venous disease (CVD) patients, Raju and colleagues found that only 21% of the patients for whom GCT was prescribed used the prescribed graduated compression stockings every day, with 12% using them for most of the day as is desirable.[28] Ziaja and colleagues, in a much larger study (16,770 patients) reported 37.4% compliance among patients coming for follow-up visits.[9] Moffat and colleagues reviewed studies on compliance and reported

that in real-life situations (outside of randomized controlled trials), noncompliance was as high as 80%.[29] They found that patients' poor compliance was associated with much slower healing and 2 to 20 times more recurrence.[29]

Treatment failure has also been noted as a challenge, though noncompliance is blamed for a substantial proportion of treatment failure. Still, some studies have reported treatment failure rates as high as 37 % even when patients are reported to have been compliant.[9,28]

Other challenges include comfort, poor cosmesis, ease of use, and cost.[28]

Rarely, limb-threatening vascular compromise has been reported as a complication of GCT, especially when GCT is used injudiciously in very swollen limbs.[30] There have also been some case reports of nerve injury[31,32] and ulcer development[30,33] resulting from inappropriate use of compression stockings.

In addition to these challenges, many studies have reported that GCT is often not prescribed to patients who may benefit from such therapy. Raju reported that 30% of patients who would have benefited from GCT for the treatment of CVD did not receive a prescription for graduated compression stockings.[28] In a study by Ziaja, almost half of the patients (46.6%) for whom GCT was indicated did not have it prescribed.[9]

In the present study, the greatest challenge that most respondents in the present study cited was availability. This partially explains the lower than expected usage of GCT for patients who would potentially benefit from it. Improved availability may, therefore, increase the utilization of GCT. Quality (20%) and cost (11%) were the second and third most cited challenges. These need to be addressed to improve GCT utilization in the region.

It is noteworthy that no surgeon reported any of the major adverse events associated with inappropriate use of GCT, such as limb-threatening ischaemia, nerve injury, or the development of new ulcers.[30–34] Surgeons and physicians must always remember that these complications can occur if graduated compression stockings are used injudiciously. Also of note is that surgeons did not report encountering treatment failure among the patients for whom they prescribed GCT.

Surgeons were asked to report the benefits that they have experienced with the use of graduated compression stockings. This question was open-ended, and that may have led to the low response rate (58%) relative to the other questions. The most frequently reported benefit was their efficacy in the prevention of VTE. Other reported benefits included effectiveness in the treatment of venous disorders, decreased limb swelling, healing of venous ulcers, as well as decreasing pain; all of these benefits can be summarized as efficacy in the treatment of venous disorders.

A limitation of this study is that we relied entirely on the opinion and recall of individual surgeons.

Conclusions

In the COSECSA region, surgeons of a variety of surgical specialities manage many patients with venous disorders or those at risk of VTE who would benefit from the use of graduated compression stockings.

Most of these surgeons prescribe graduated compression stockings for patients with venous disorders, with the most frequent indications being Varicose veins and VTE prophylaxis. The commonest indications for which surgeons prescribed GCT varied by speciality.

The mean number of prescriptions per surgeon per year was meagre compared to the number of patients encountered either diagnosed with venous disorders or at risk of VTE. Our results suggest that limited availability of compression stockings is an important contributor to the apparent shortfall in GCT prescriptions.

Competing interests

Both authors declare that they have no competing interests related to this work.

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