The aesthetic upper arm

I. On the anatomy and classification of the lipodysmorphic upper arm

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Keywords:

Lipoedema, bariatric atrophy, brachioplasty, fascia brachialis, retinacula cutis, fat compartiments

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lipedema- bariatric atrophy - brachioplasty - fascia brachialis - retinacula cutis - fat compartiments

1. introduction:

For women with ideal body contour and body weight, it is often impossible to achieve aesthetic definition of the arms.

This goal is also unattainable for many patients who are overweight, who have radically lost weight again and especially for patients with so-called lipedema. Especially in these fatefully dysmorphic patients, excessive fat cell hyperplasia (and flaccidity) of the upper arms is to be expected in the majority of cases!

In addition to the genetically determined dysmorphia, it is mainly the ageing process and the hammock-like atrophy of the affected fascial systems that cause the cutaneous-subcutaneous structures of the upper arms to slacken. UV damage to the cutis and, above all, inactive atrophy of the arm and shoulder girdle muscles are significant factors in aesthetic upper arm problems. Also to be included in the aetiology are the interrelationships of the subcutaneous fascia (fascia brachialis), the connective tissue retinacula and the quantities of fat tissue embedded in them.

2. anatomy

The studies were carried out at the Institute of Anatomy at the Medical University of Graz. Seven arms with dysmorphic and normal appearance of female patients aged 53 to 74 years were dissected, and liposuction was performed on three upper arms. The preparations were tumesced with H2O (3 litres per arm) before liposuction. Liposuction was performed with the Micro Aire System as in the living patient; 250 to 600 ml (lipoedema) were suctioned per arm to visualise the connective tissue structures.

The section was performed on the proximal forearms and the entire upper arms, including the shoulder muscles attached to the humerus, in layers.

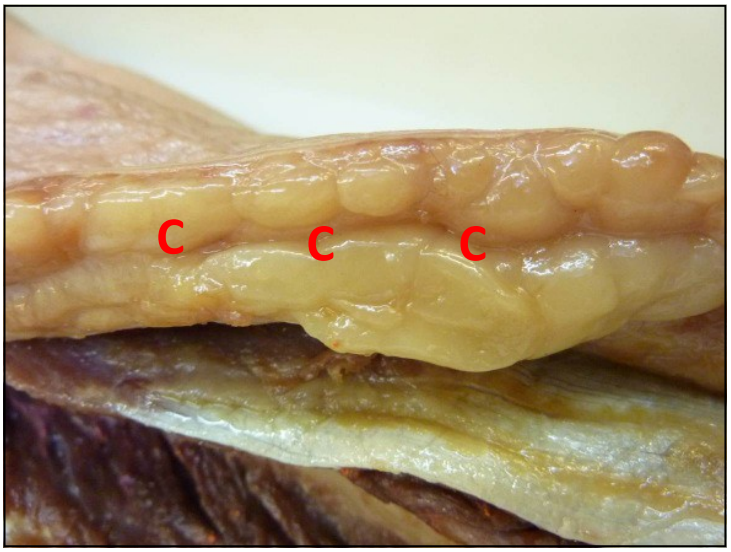

Figure 1: In a normally structured upper arm (N), a moderate two-layered fat body with a clearly defined Camper's fascia was found laterally. (C)

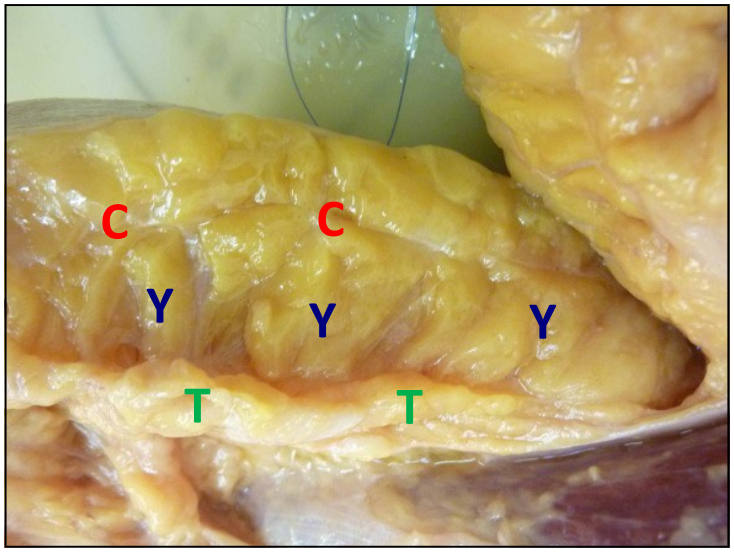

Figure 2: In a lipoedema specimen, an enormous layer of fat was found posterolaterally with regular subdermal Camper's plexus (C), a thick intermediate layer of fat (Y) and a layer of fat deeply attached to the fascia brachialis (T).

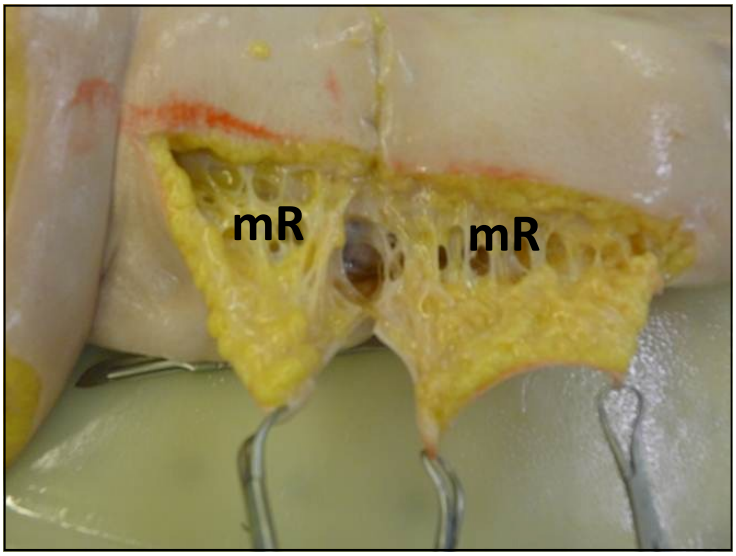

Figure 3: After suctioning a regular me- dial humerus, we were able to verify the resting retinacula cutis (mR). (*Preparation by suction)

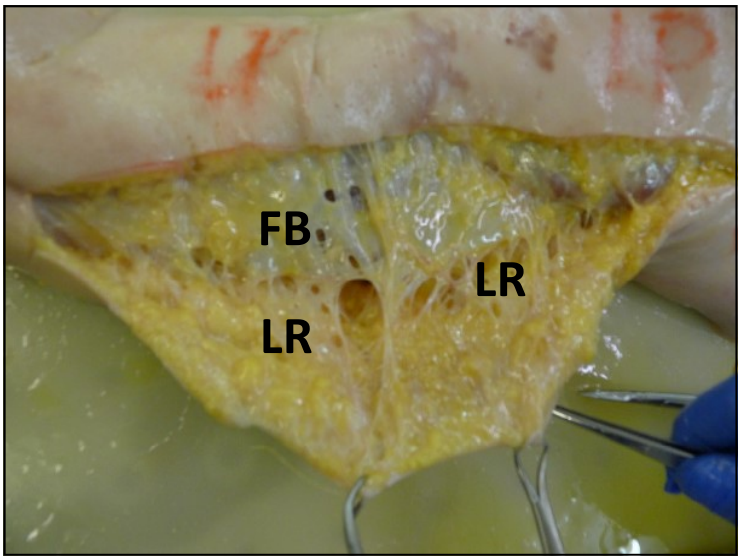

Figure 4: We were able to visualise a much denser arrangement of the retinacula (LR) posterolaterally. Posteriorly, we can also see a sagging of the fascia brachialis.(FB) (*Preparation by suction)

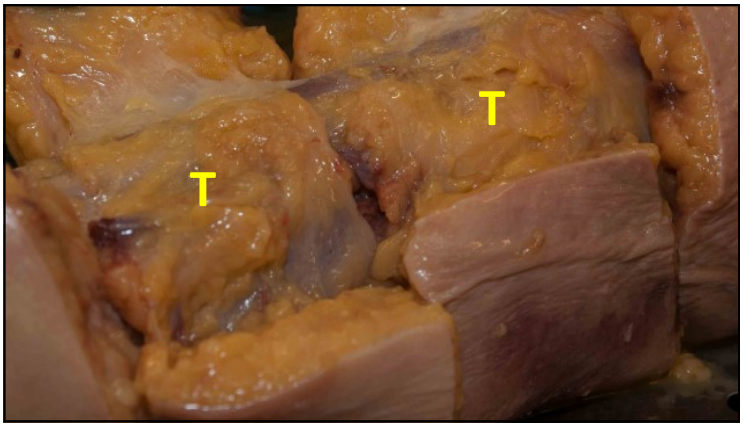

Figure 5: During the layer-by-layer preparation, we were able to verify the third tricipital fat layer (T) on the fascia brachialis posteriorly.

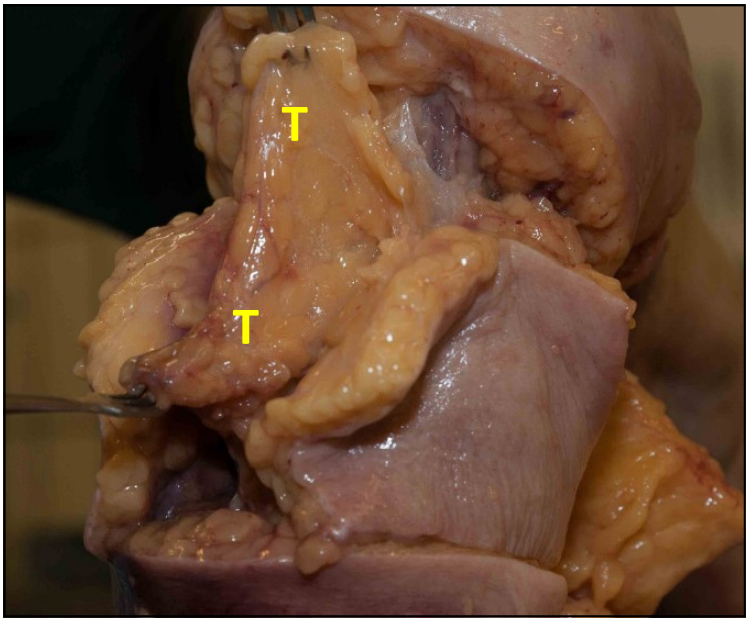

Figure 6: This "triceps fat body" (T) can be lifted off the musculature together with the fascia brachialis. There are no muscle adhesions poste- riorly

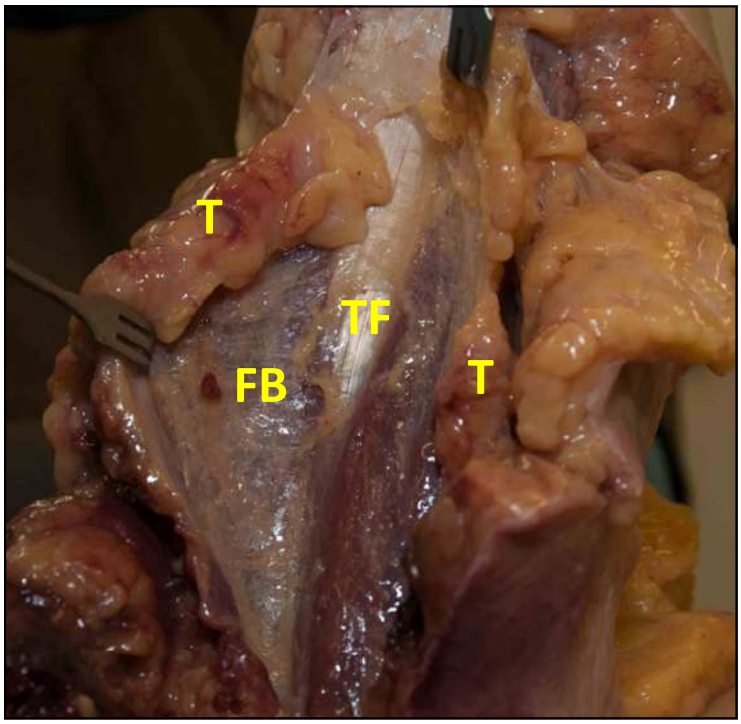

Figure 7: After cutting the fascia bra- chialis (FB) and the overlying fat body (T), the triceps muscle fascia (TF) becomes visible.

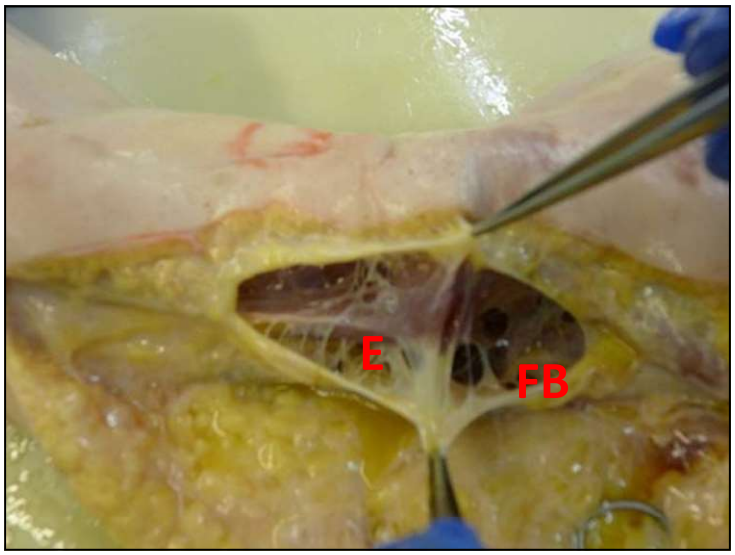

Figure 8: Posteromedially, entanglements of the fascia brachialis (FB) with the epimysium (E) of the triceps muscle are visible. (*Preparation by suction)

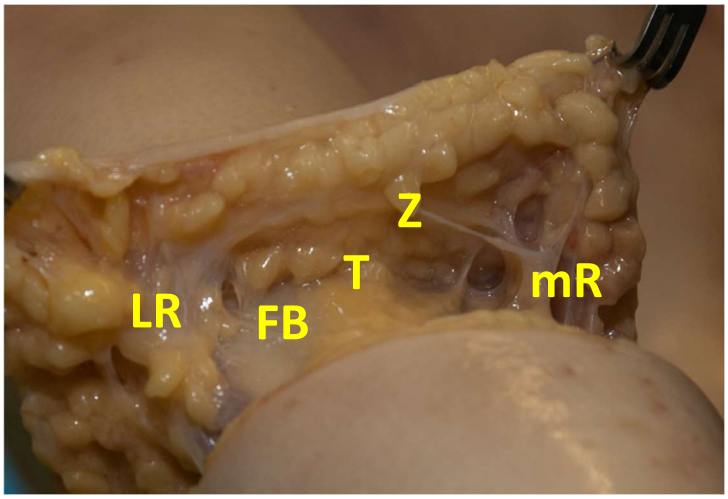

Figure 9: Suctioned humerus, sectional plane in the distal third, proximal view: tunnel-like representation of the deep triceps fat body (T) with basal fascia brachialis (FB) and roof-like intermediate fascia (Z), laterally dense, coarse retinacula (LR), medially solitary narrow band retinacula.(mR) (*Preparation by suction) (see also figure 3+4 from another viewpoint)

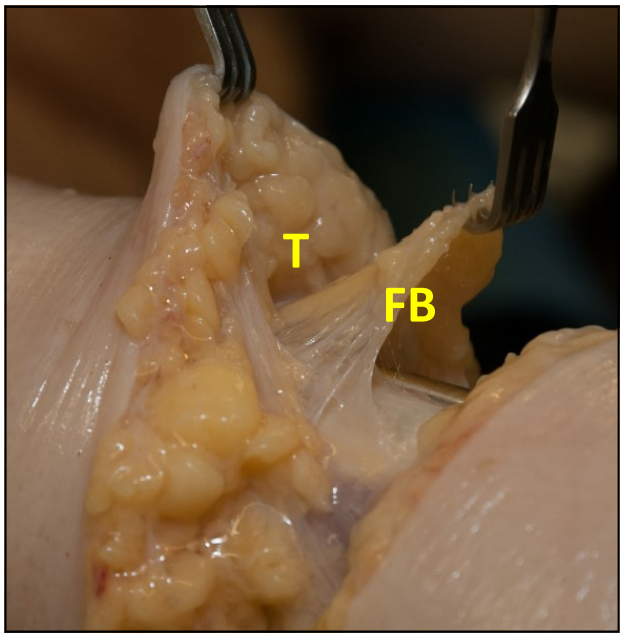

Figure 10: In the side view of the previous preparation (Figure 9) we were able to show the sagging of the fascia bra- chialis (FB), above it again the tunnel-like triceps fat body. (T) (*Preparation by suction)

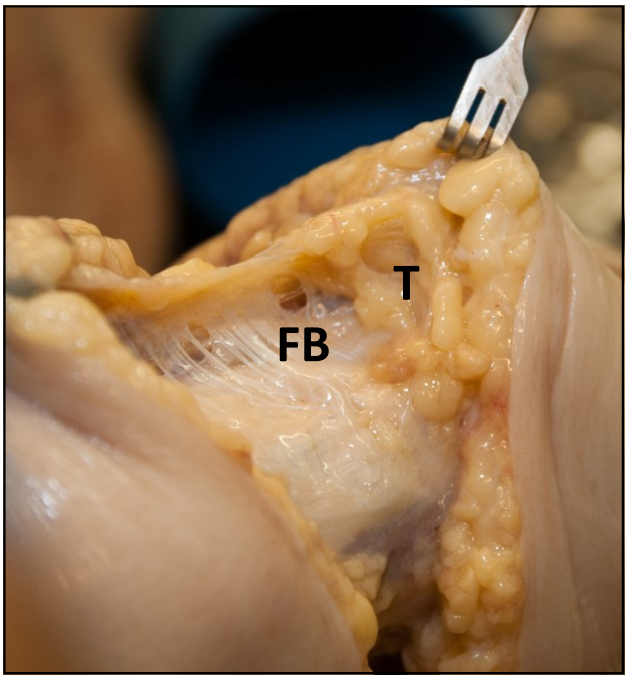

Figure 11: The same preparation with a view in the direction of the olecranon (to distial), whereby the sagging phenomenon of the fascia brachialis (FB) can also be seen here, above which the third fat body (T) is also clearly visible. (*Preparation by suction)

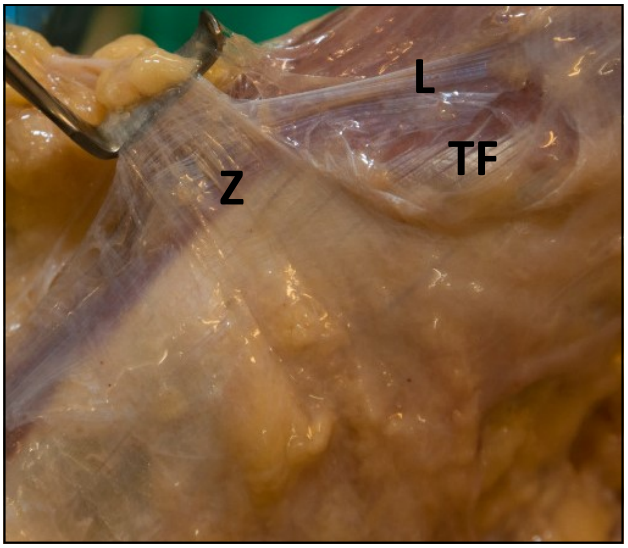

Figure 12: After ablation of the fat bodies, both the longitudinal and circular fibres are visible.
(Z) of the fascia brachialis over the triceps muscle fascia (TF). (*Preparation by suction)

Figure 13: A lipoedema preparation also shows the three-layered nature of the fat on the ulnar forearm.

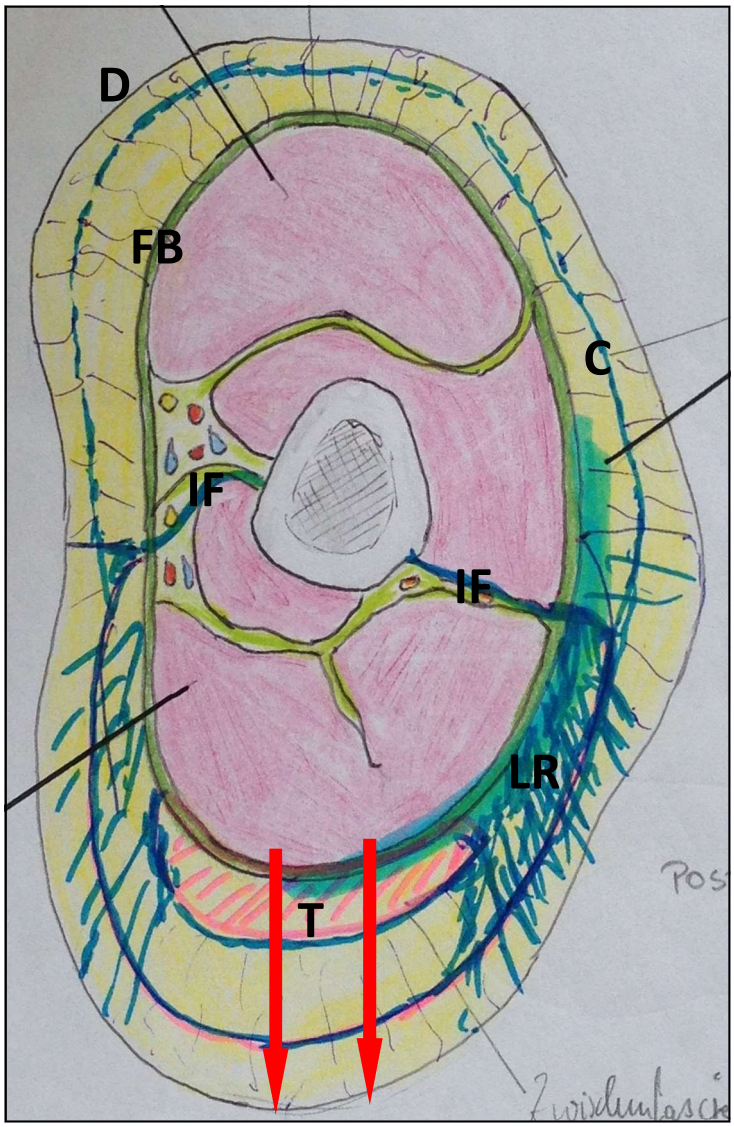

Figure 14: Based on the dissections we performed, we were able to characterise the dynamics of the sagging upper arm. In the foreground is the muscle atrophy, the sagging of the fascia brachialis (FB) with its mainly laterally positioned retinaculum cutis (LR). The fat body (T) positioned above the triceps muscle is also affected by this sagging phenomenon.

Camper's Fascia (C)
Intermuscular fascia strands (IF)
Dermis (D)

Ptose ⬇

Huijing (16) et al 2003 have shown that about 70% of the muscle dynamics are transformed via tendons and bones into the direct movement process and surprisingly 30% into the surrounding connective tissue. This fact alone underlines the importance of muscle atrophy in the genesis of flaccid upper arms.

There are several support systems that hold the skin, muscles and fat in place on the upper arm, resulting in a youthful contour of the upper limb.(1,2,3)

First of all, the fascial system of the shoulder girdle and the fascia brachialis, which fixes the subcutaneous fat tissue of the arm, and thus the skin, from the axilla to the elbow (8,9) with its retinacula. With age, the skin and subcutis gradually lose their elasticity, leading to aesthetic arm deformities, although the loss of fat also contributes! In the past, this process was considered the primary cause of upper arm ptosis.

A second and perhaps more important support is given to the soft tissues of the upper arms through fascial connections from the shoulder girdle muscles.

The brachialis fascia receives stranded support from the pectoralis major, deltoid and latissimus dorsi muscles (8).

This fascial support of the shoulder girdle finds its starting points medially and especially la- terally at the intermuscular fascial cords, which attach to the periosteum of the humerus (IF). The fascia brachialis is also much more pronounced in the posterolateral region in analogy to the fascia lata of the thigh. Laterally, the retinacula cutis are also denser and more dynamic than me- dial, which is also responsible for the lower displaceability of the entire lateral humeral cutis. The posterolateral fat body has both a pronounced Camper's interfascia and, in addition, a third fat body that slides on the muscle tendon of the triceps brachii! (17)

Here, the atrophy of the triceps brachii muscle, the sagging of the fascia brachialis, the atrophy of the tricipital fat body with medial displacement of the fixating lateral retinacula play the decisive role in the upper arm symptoms.

Muscle dynamics are transmitted through the epimysium via the retinacula into the fascia brachialis, and from there via the retinacula cutis and intermediate fasciae into the dermis.

In contrast to the F. brachialis in the biceps region, the anatomical, mechanical interaction between muscles and skin is more pronounced in the posterolateral region due to the fascia and retinacula structure. The ageing process is therefore more effective in this region.

The dynamics of the intermuscular fascia strands between the biceps and triceps are also significantly pronounced, which also slacken with age. Slackening and atrophic muscles and their fasciae thus also increase the sagging of the subcutaneous structures.

Other factors to be considered are dermal and epidermal atrophy as a result of UV exposure and certain intrinsic factors (e.g. hormone therapy, genetics).

For the safety of surgical techniques, the topography of the blood and lymph vessels as well as the nerve cords of the arm must be taken into account. The antebrachial cutaneous nerve is rarely, but nevertheless, injured. It is particularly at risk during excision techniques of the brachial sulcus. Lymphological complications also tend to occur when the main collectors in the brachial sulcus are irritated. (13,14)

3. appearance and classification

The flaccidity and the fat content of the subcutis are the main actors of the dysmorphic upper arm. The training condition of the musculoskeletal system is also a determining factor. Independently of this, there is lipoedema, which has received little attention to date, in which there is usually an excess of fat, combined with pressure pain and a tendency to spontaneous haematoma. (4) It is a fatty tissue hyperplasia, whereby both the upper arms in their entire circumference and often also the lower arms are completely characterised by a multi-layered accumulation of fatty tissue.

Figure 15: Upper arm of a lipedema patient

This condition can neither be influenced by diet nor by physical training. Another special condition is the drooping upper arms (bat wings) in bariatric patients; in excessive ptosis there is mainly low-fat excess skin. Here, too, muscle work (training) cannot influence the picture. It is precisely this patient group that has made brachioplasty, which used to be performed rarely, a frequent occurrence.

Figure 16: Bariatric upper arm after weight loss of 90 kg ! Massive ptosis cannot be compensated even by muscle strengthening.

Classification: **B**,4-4-1

In order to be able to classify all dysmorphic patients accurately, these two manifestations must be implemented in the classification as well

(**L-** Lipoedema, **B-** Baritric, **N-** Normal patient)

Independent of the clinical diagnosis, the assessment of the ptosis, the extent of the fat deposits but also the muscle condition must be evaluated. To determine the ptosis, the outgoing measuring point for us is the sulcus bicipitalis medialis, 7 cm from the deepest depression of the anterior axillary fossa: Whereby depending on the sagging - grade 2: 3 to 5cm, grade 3: 5 to 10cm and grade 4 over 10 cm are measured. Furthermore, the fat content of the upper arm structures is to be assessed: 1 excess fat, 2 normal, 3 moderate atrophy, 4 severe atrophy. The musculature is assessed as hypertrophic (1), normal (2), moderate atrophic (3) and severe atrophic (4). Included in the classification are the clinical presentation of lipoedema (L), bariatric history (B) and normal patients (N). Rare lipomatoses such as Lannois-Bensaude syndrome etc. must be listed separately!

Figure 17: Normal patient with moderate ptosis, normal fat content and good muscle profile Classification: **N**, 2-2-1

Figure 18: Marking + ptosis determination of a lipoedema upper arm

Classification: **L**, 3-1-3)

Classification and preoperative marking should be done in ninety degrees abduction posture in shoulder
- and elbow joint can be made.

Clinic	Normal (**N**)	Lipedema (**L**)	Bariatric (**B**)

Table 2:

Degree	**Skin** (Ptosis,Athrophy)	**Fat**	**Muscle**
1	normal	Surplus	hypertrophic
2	moderate	Normal	normal
3	moderately difficult	moderate shrinkage	moderate shrinkage
4	heavy	massive loss	massive athrophy

4. discussion:

The treatment of the upper arm depends primarily on the diagnosis and subsequently on the anatomical target structures. Up to now, lipedema has hardly been considered in the literature in this context, but it is of enormous importance because of its frequency (5-10% of the female population). (4) Also to be considered are bariatric clinical pictures and the extremely rare pathological lipodysmorphia (Derkum's disease etc.), the latter are not included in the classification. The definition of the anatomical structure to be treated is crucial. If there is only hypertrophy of the fatty tissue, liposuction is the treatment of choice.(10) In cases of moderate or severe ptosis, thermal procedures such as laser lipolysis (LLL) and radiofrequency assisted liposuction (RFAL) should be considered. While the interstitial laser treatment has a non-specific thermal effect, the RAFL treatment (Invasix) has a specific tightening effect on the connective tissue structures(11,12,13). The specific application is to address deep layers posteriorly and posteriolaterally. This refers especially to patients with ptosis. In this case, one should also be very cautious with suction and possibly consider a second session. To tighten the superficial dermal structures, bipolar RF procedures such as FaceTite or IntraCell procedures should be used.

In lipedema patients, the use of lymphological liposculpture according to Cornely (4) with vibrating cannulas and tangential suction in tumescent local anaesthesia seems to us to be very important. Especially the main collectors in the sulcus brachialis should be spared. Brachioplasty with all its side effects seems to us to be unnecessary in most upper arm dysmorphia, with the exception of severe bariatric upper arms with excessive ptosis and fat atrophy(14).

The anatomical and clinical studies are an ideal starting point for further therapeutic options.

5. summary:

1. The muscle atrophy leads to a massive sagging of the upper arm via the fascia brachialis and retinacula cutis.
2. The posterior deep fat compartment hangs through together with the fascia brachialis over the triceps muscles.
3. The manifestation of lipedema is far too little included in the treatment planning of the upper arm.
4. The anatomical structures determine the therapeutic options.

Summary:

1. The muscular atrophy leads across the Fascia brachialis and retinacula cutis to substantial sagging of the upper arm.
2. The posteriore deep fatcompartiment sags together with the Fascia brachialis over the Tricepsmuscle.
3. The lipedema manifestation is included much too few in planing the surgery of the upper arm with.
4. The anatomical structures decide on the therapeutic options.

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