Postoperative mobilisation of the obese patient

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Review

Evidence for prescribing exercise as therapy in chronic disease

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Considerable knowledge has accumulated in recent decades concerning the significance of physical activity in the treatment of a number of diseases, including diseases that do not primarily manifest as disorders of the locomotive apparatus. In this review we present the evidence for prescribing exercise therapy in the treatment of metabolic syndrome-related disorders (insulin resistance, type 2 diabetes, dyslipidemia, hypertension, obesity), heart and pulmonary diseases (chronic obstructive pulmonary disease, coronary heart disease, chronic heart failure, intermittent claudication), muscle, bone and joint diseases (osteoarthritis, rheumatoid arthritis, osteoporosis, fibromyalgia, chronic fatigue syndrome) and cancer, depression, asthma and type 1 diabetes. For each disease, we review the effect of exercise therapy on disease pathogenesis, on symptoms specific to the diagnosis, on physical fitness or strength and on quality of life. The possible mechanisms of action are briefly examined and the principles for prescribing exercise therapy are discussed, focusing on the type and amount of exercise and possible contraindications.

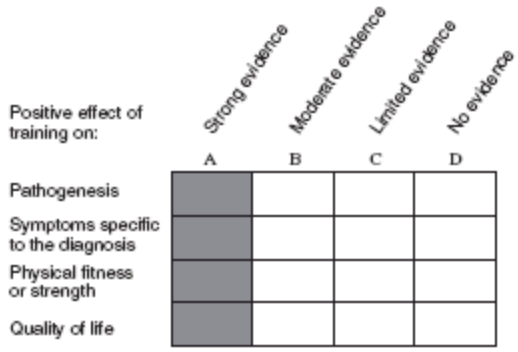


Fig. 1. Insulin resistance.

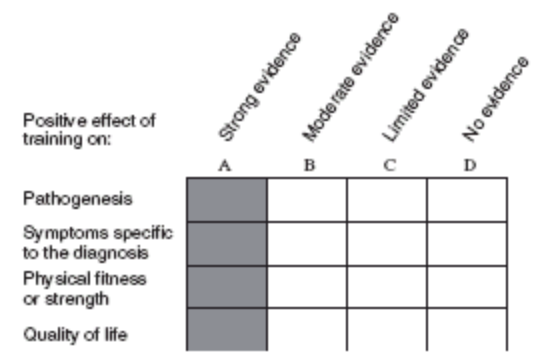


Fig. 2. Diabetes type 2.

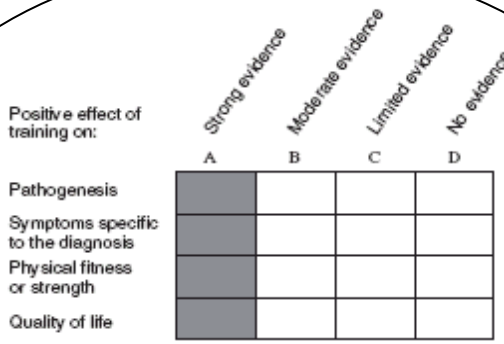


Fig. 5. Obesity.

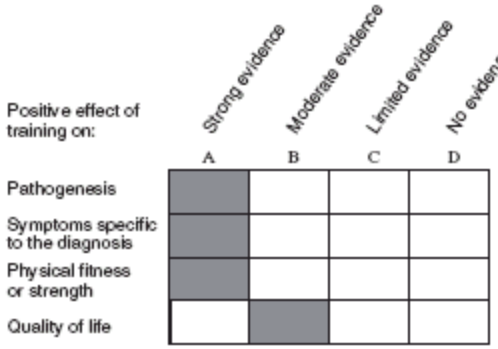


Fig. 3. Dyslipidemia.

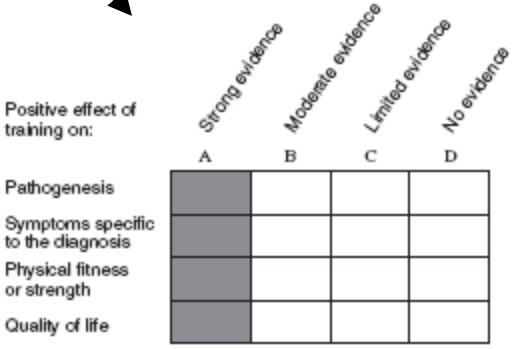


Fig. 4. Hypertension.

Morbidly obese

Prevalence increasing rapidly in USA and Europe

Bariatric surgery (gastric bypass):

+ Body composition
  Cardiovascular risk profile
  Metabolic profile
  Mortality rate
  comorbidities

? • Physical fitness (aerobic capacity, muscle strength and functional capacity)

Morbidly obese

Poor aerobic fitness:

- reduced cardiovascular function
- reduced relative muscle strength
- low oxidative muscle capacity
    * fiber type distribution and low mitochondrial function
    * high proportion of type 2 (anaerobic)
    * high proportion of type 1 (aerobic)

Morbidly obese

Weight loss (diet programs):

- increase of cardiovascular function
- decrease in strength
    * loss of fat free mass
- oxidative muscle capacity =
- mitochondrial content = and mitochondrial size ↓
- electron chain transport =

Morbidly obese

Bariatric surgery:

- loss of fat free mass
- skeletal muscle atrophy (Carey 2006)
- Functional capacity:
    * 6 minute walk distance ↑ (Maniscalco 2006, Tompkins 2008)
    * Discussion:
        ° loss of fat mass
        ° increased functionality ?

Two questions:

1) Effect of gastric bypass surgery on physical fitness (aerobic capacity, muscle strength and functional capacity)?

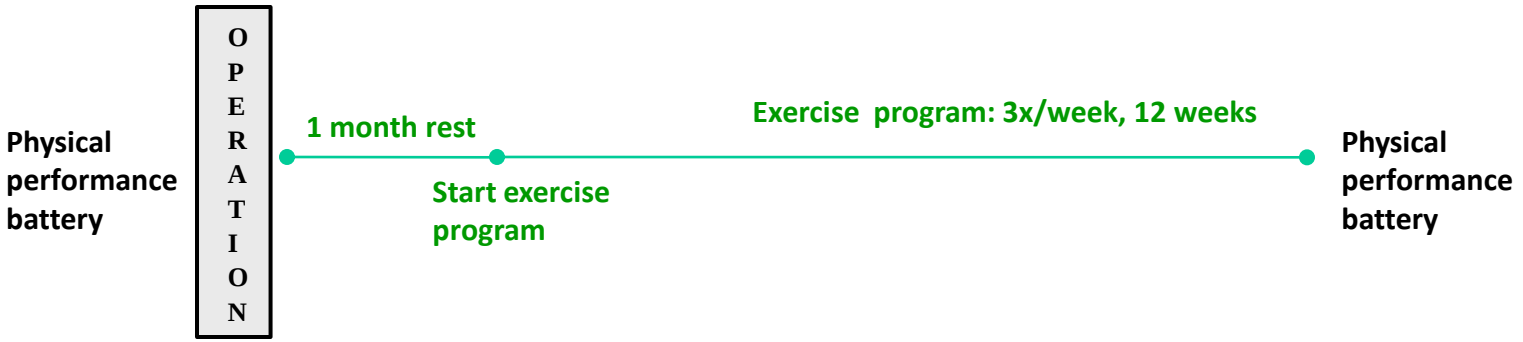
2) Feasibility and effectiveness of an exercise program starting one month after the operation?

Study design

Table 1: Pre-operative **characteristics** of the study groups (GB and GB + E).

	Gastric bypass without exercise (GB)	Gastric Bypass with exercise (GB + E)
Number (n)	7	8
Age (years)	43,1 (± 5,6)	39,9 (± 9,9)
Gender male/female (n)	3/4	1/7
BMI (kg/m2)	40,4 (± 8,1)	45,3 (± 2,7)
Operation	7 gastric bypass (of which 2 conversions)	8 gastric bypass (of which 2 conversions)

Data are presented as n or means ± SD.



Measurements:

- Body composition and anthropometrical variables:
  - Weight, length, BMI, fat mass, fat free mass

- Physical performance battery
  - 1 Repetition Maximum of lower and upper limb
  - Hand grip strength
  - Muscle fatigue
  - Sit-to-stand
  - Maximal exercise testing (peak VO2 and ventilatory treshold)
  - 6 minute walk test

Intervention: exercise program: combination of strength and endurance training!

- 3x/week during 12 weeks
- each session: 1h15min

- Strength training: using stack weight equipment
  - Exercises: biceps L&R, triceps L&R, quadriceps L&R, hamstrings L&R
  - Intensity: 2x15 repetitions (60%RM) -> 3x10 repetitions (75%RM)
- Endurance (aerobic) training
  - Exercise:10 min cycling, 10 min stepping, 10 min walking
  - Intensity: 60% -> 75% heart rate reserve

Results

Table 2: Absolute and relative changes in **anthropometrical characteristics** and **body composition** 4 months after gastric bypass. Comparison GB and GB+E.

		PRE-operative values	Absolute decrease	Relative decrease (%)	Time (p-value)	Interaction (p-value)
Weight (kg)	GB	126,5 (± 24,7)	-26,6 (± 14,6)	-20,1 (± 8,7)		
	GB+E	130,8 (± 17,8)	-22,7 (± 5,7)	-17,9 (± 5,8)	0,000	0,511
BMI (kg/m^2)	GB	40,4 (± 8,1)	-8,3 (± 4,1)	-20,1 (± 8,7)		
	GB+E	45,3 (± 2,7)	-8,1 (± 2,5)	-17,9 (± 5,8)	0,000	0,889
Waist (cm)	GB	129,7 (± 20,1)	-20,3 (± 11,6)	-15,3 (± 8,3)		
	GB+E	139,4 (± 11,8)	-17,2 (± 8,1)	-12,3 (± 5,7)	0,000	0,555
FFM (kg)	GB	69,0 (± 13,5)	-7,6 (± 4,7)	-10,5 (± 4,6)		
	GB+E	63,9 (± 14,2)	-5,4 (± 2,6)	-8,5 (± 4,3)	0,000	0,299
FM (kg)	GB	57,5 (± 14,0)	- 19,0 (± 10,2)	-32,1 (± 15,1)		
	GB+E	66,7 (± 9,0)	-17,3 (± 4,6)	-26,8 (± 9,8)	0,000	0,689
% FFML	GB	/	/	-29,7 (± 8,2)	Indep. T-test (p-value)	
	GB+E	/	/	-22,4 (± 10,1)	0,166	

Without exercise

With exercise

Abbreviations: (GB) group with only Gastric Bypass surgery, (GB+E) Gastric Bypass surgery and exercise program, (BMI) Body Mass Index, (FM) Fat Mass, (FFM) Fat Free Mass and (%FFML) %fat mass loss of total weight loss.
No interaction effects were recorded using ANOVA for repeated measures. P-values for overall intervention (exercise program) and time effects are given. Data are presented as means ± SD.

Physical fitness (Muscle strength)

Table 3

Dynamic muscle strength	GB (%)	GB+E (%)	p-value (Interaction)
Δ Quadriceps	- 16	+ 72	0.002
Δ Hamstrings	- 16	+ 27	0.094
Δ Biceps	- 36	+ 12	0.001
Δ Triceps	- 40	+ 11	0.038

GB: Gastric bypass (WITHOUT exercise)
GB+E: Gastric bypass WITH exercise

P< 0.05

P≤ 0.09



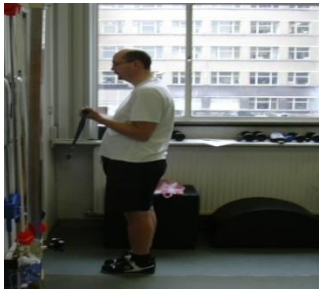
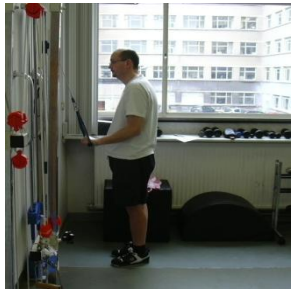
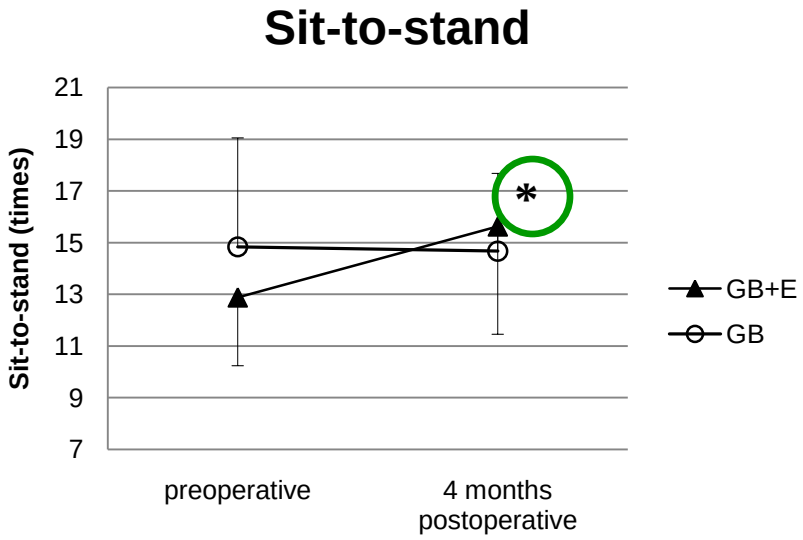
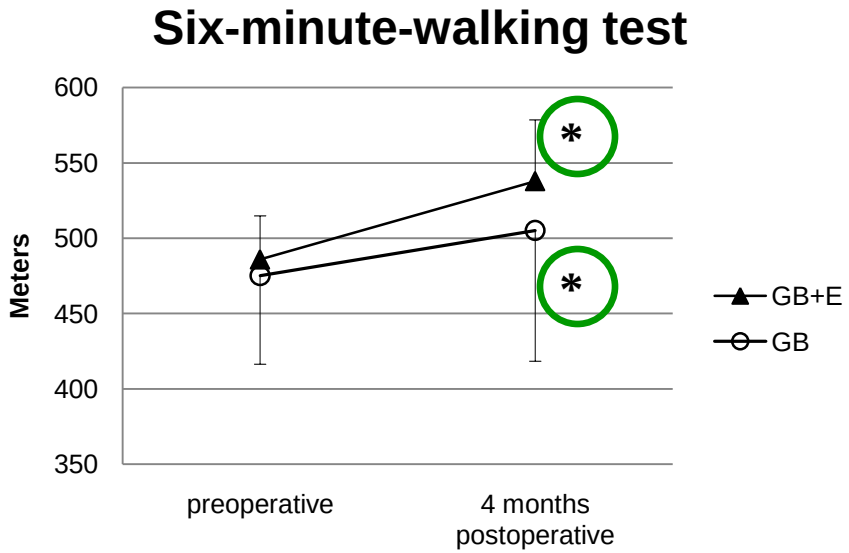



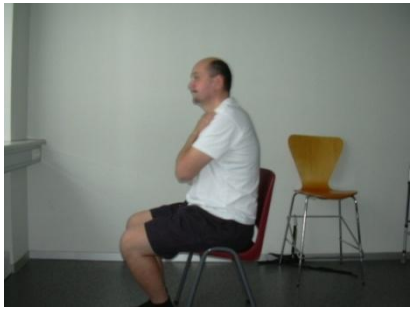
Table 4

Static peripheral muscle capacity	GB (%)	GB+E (%)	p-value (Interaction)	p-value (Time)
Δ Handgrip strength	- 18	- 7	0.340	0.008
Δ Muscle fatigue	- 9	+ 44	0.199	0.562

Physical fitness (functional capacity)







GB: Gastric bypass (WITHOUT exercise)
GB+E: Gastric bypass WITH exercise

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Physical fitness (exercise capacity)

Aerobic capacity

Fig. 1: Time of occurrence of Ventilatory Anaerobic .Threshold (VAT)

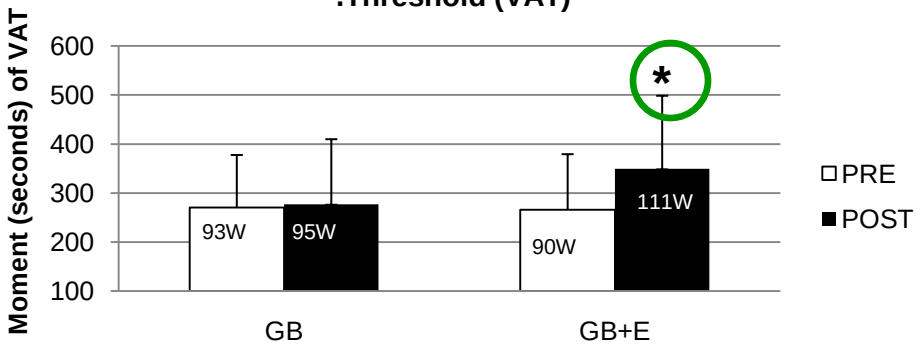
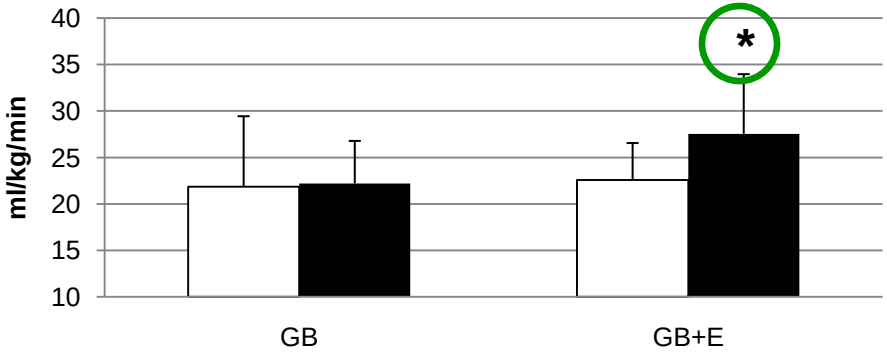


Fig. 2: Oxygen uptake at VAT/kg FFM



Peak exercise capacity

Fig. 3: Peak oxygen uptake

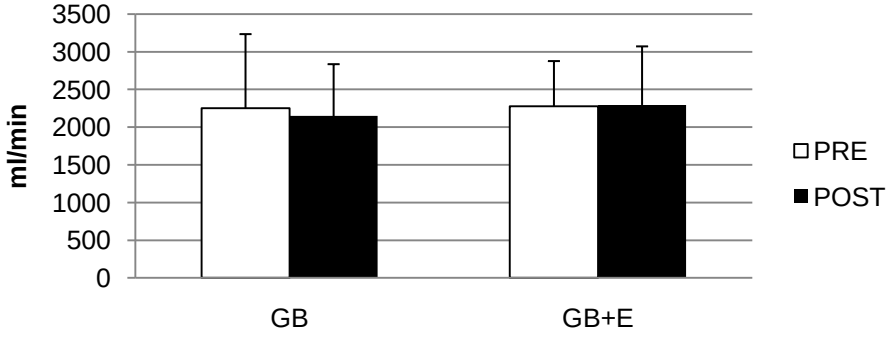
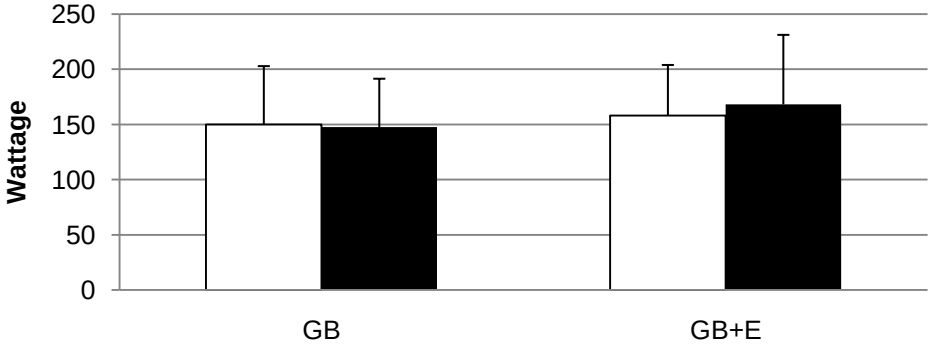


Fig. 4: Peak work output



* P < 0.05 versus pre-operatively

GB: Gastric bypass (WITHOUT exercise)
GB+E: Gastric bypass WITH exercise

Conclusion:

Gastric bypass surgery induces:

- decrease in FFM
- decrease in muscle strength
- no amelioration in functional and aerobic capacity

Exercise training after gastric bypass surgery:

- can not prevent the decrease in FFM, BUT:
- prevents the decrease in muscle strength
- increases aerobic capacity
- increases functional capacity

What is happening with the muscle histology?

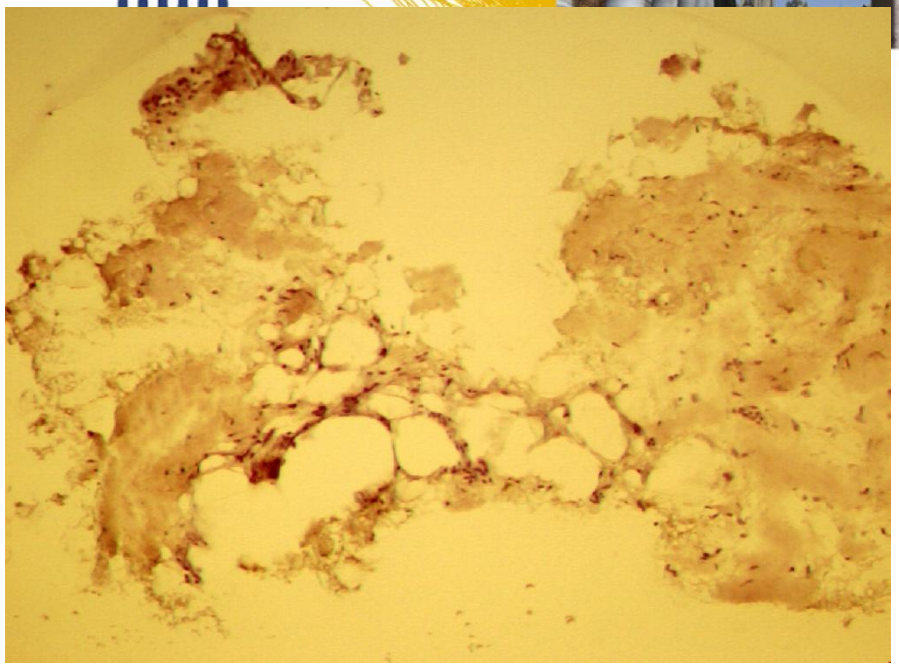
- Biopsy (biopsy gun, 14G) in m. vastus lateralis (quadriceps)

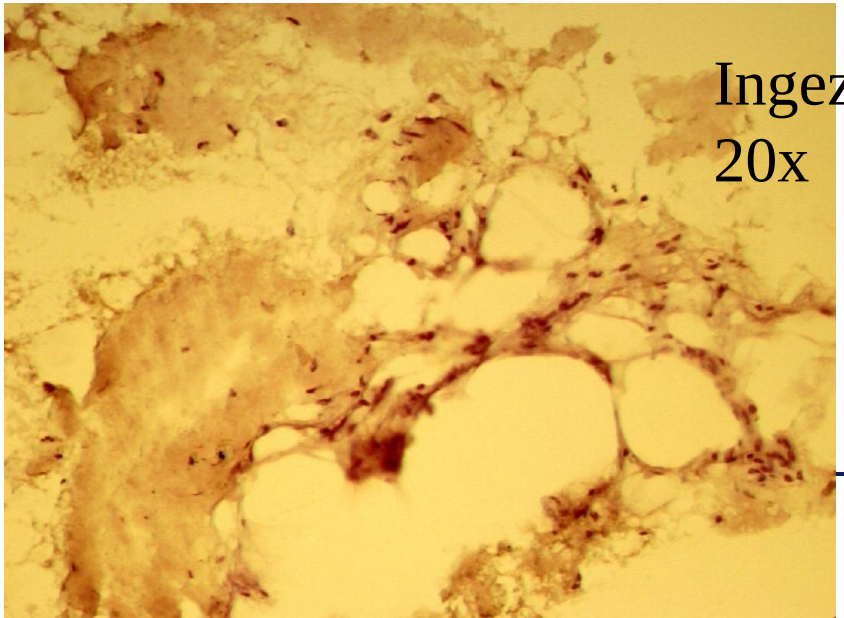
  * before surgery, 1 month after surgery (start of training program), after training program

- muscle fiber distribution
- cross sectional area of fiber
- lipid content in fiber

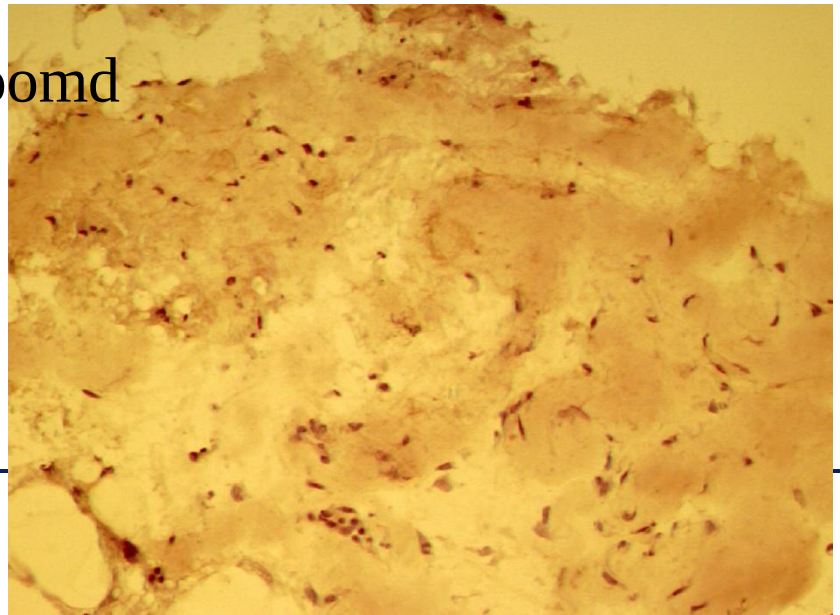
→ example (next slides)

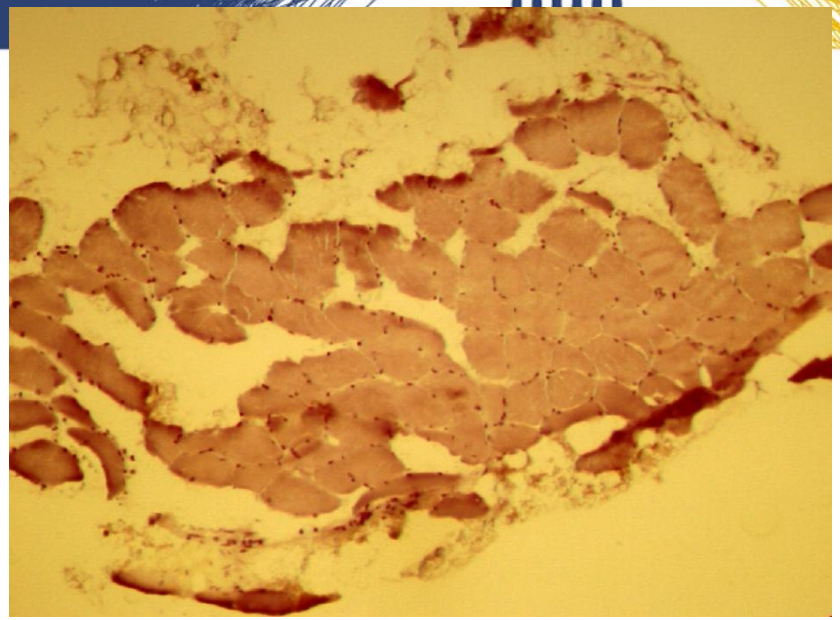
VOOR DE OPERATIE (BMI = 48 kg/m²)

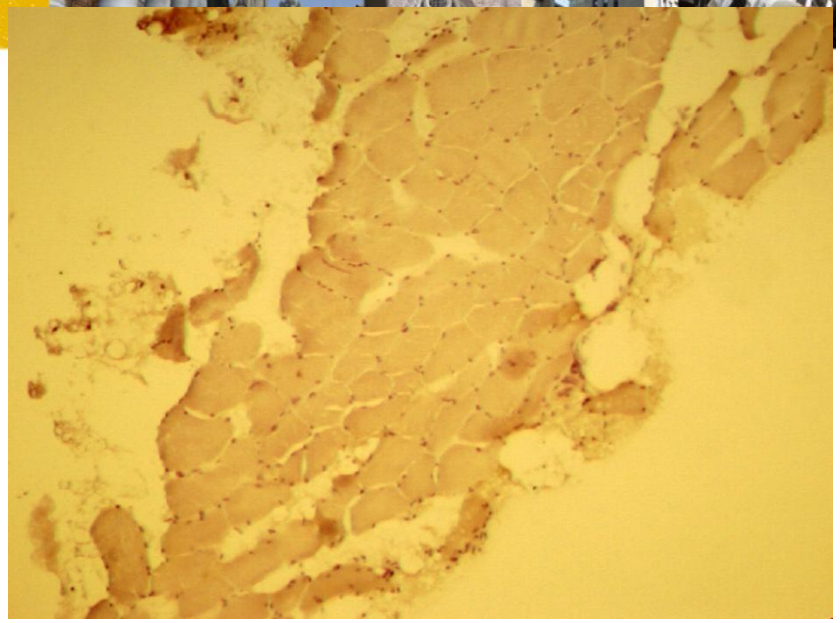




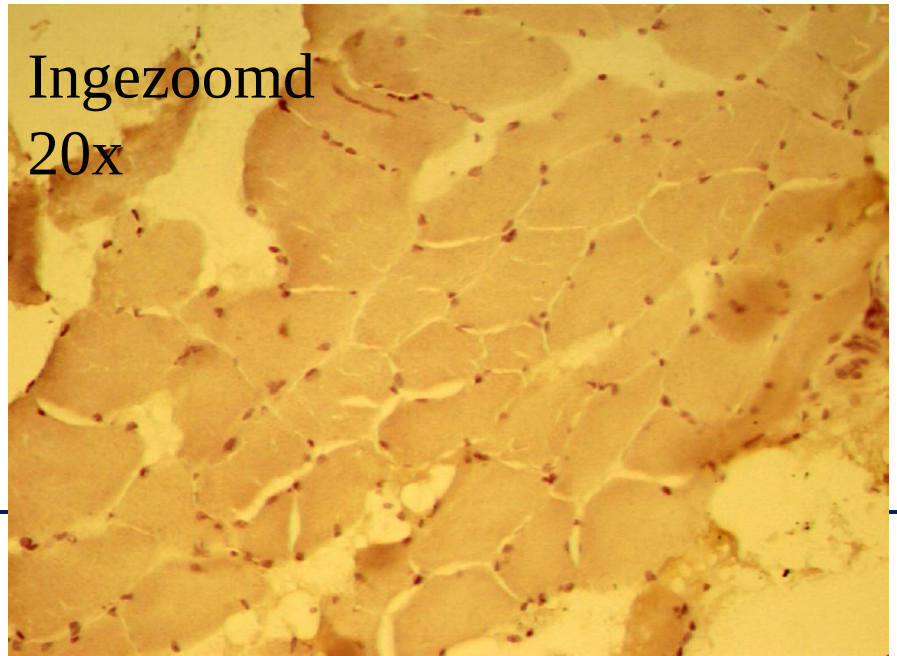
Ingezoomd 20x

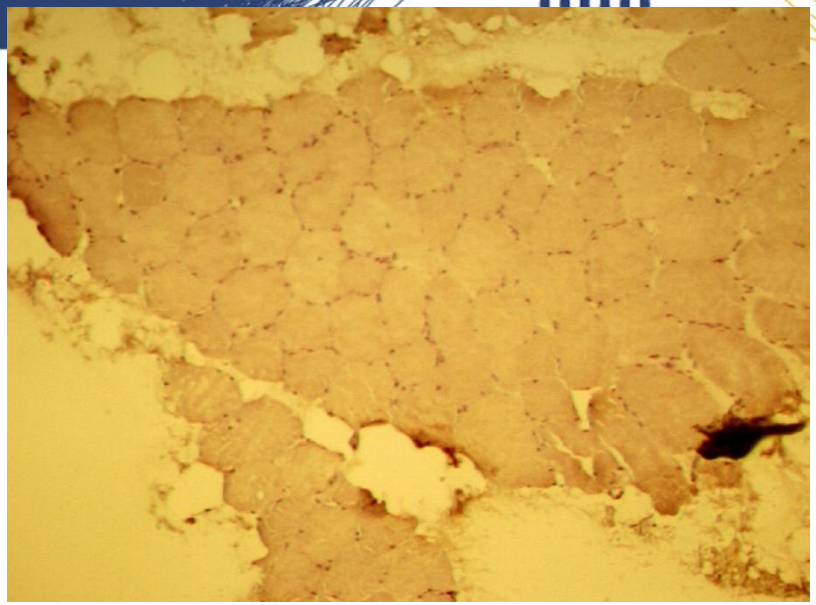


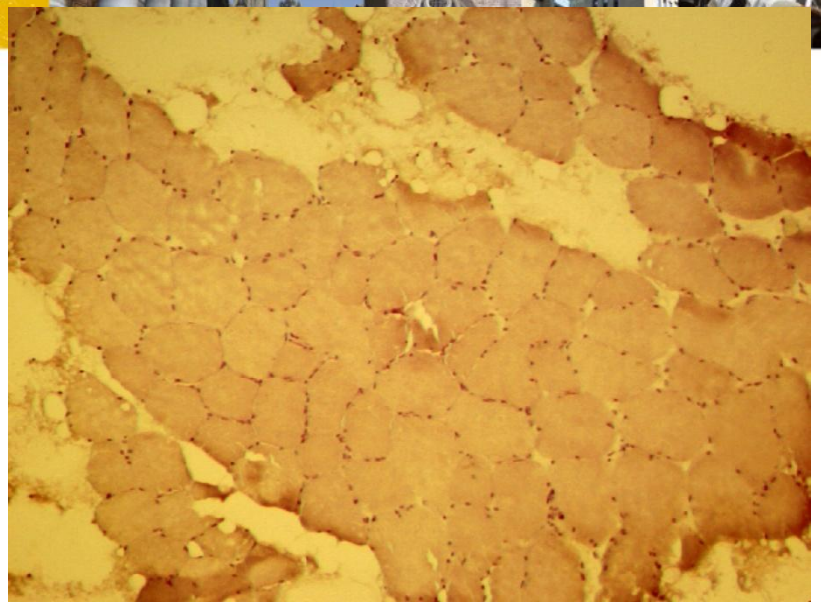




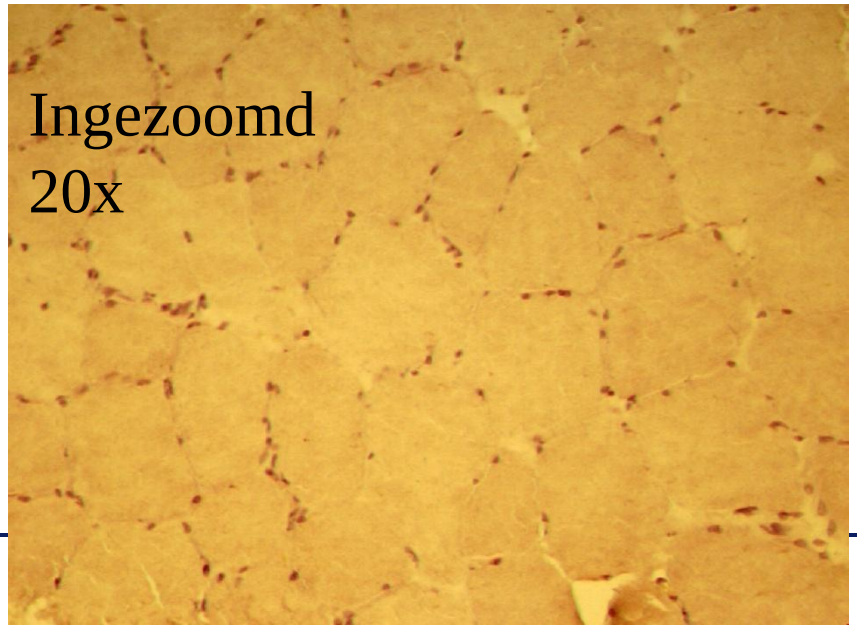
1 MAAND NA GASTRIC BYPASS (-10 KG)







4 MAANDEN NA DE OPERATIE (GASTRIC BYPASS) + KRACHT- EN UITHOUDINGSPROGRAMMA VANAF 1 MAAND NA DE OPERATIE (- 23,5 KG)



Thank you for your attention

Prof. Dr. Patrick Calders