



# Bicycling and Individually Targeted Prevention



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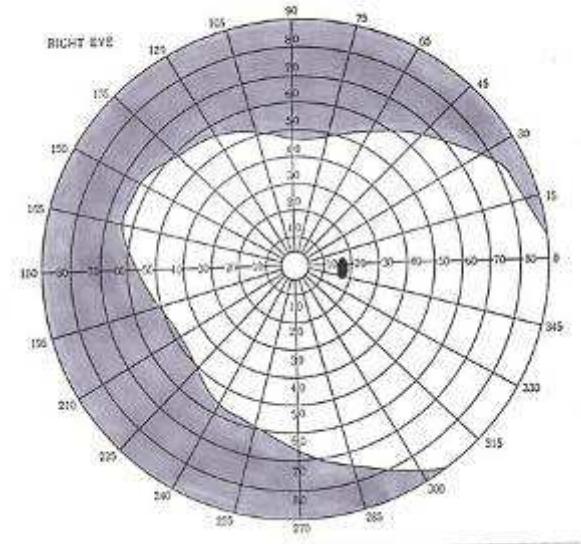
Doc. RNDr. Omar Šerý, PhD

# Vision - cycling traffic accidents

## 1) **Cataract** – 2nd most frequent cause of senior blindness (Topinková, 2005)

Amiodarone, corticosteroids, tetracyclines, salts of gold, chlorpromazine, pravastatin, inborn predispositions, eye injuries, + age, sun radiance, smoking, diabetes mellitus, chronic inflammation, oxidative stress, other metabolic disorders.

## 2) **Visual field** - horizontal 170° - youngs , 140° - 50 years glaucoma, retinal defects, etc. major cause of automobile accidents of seniors 2x ↑ collision rates (Hills BL., 1980)



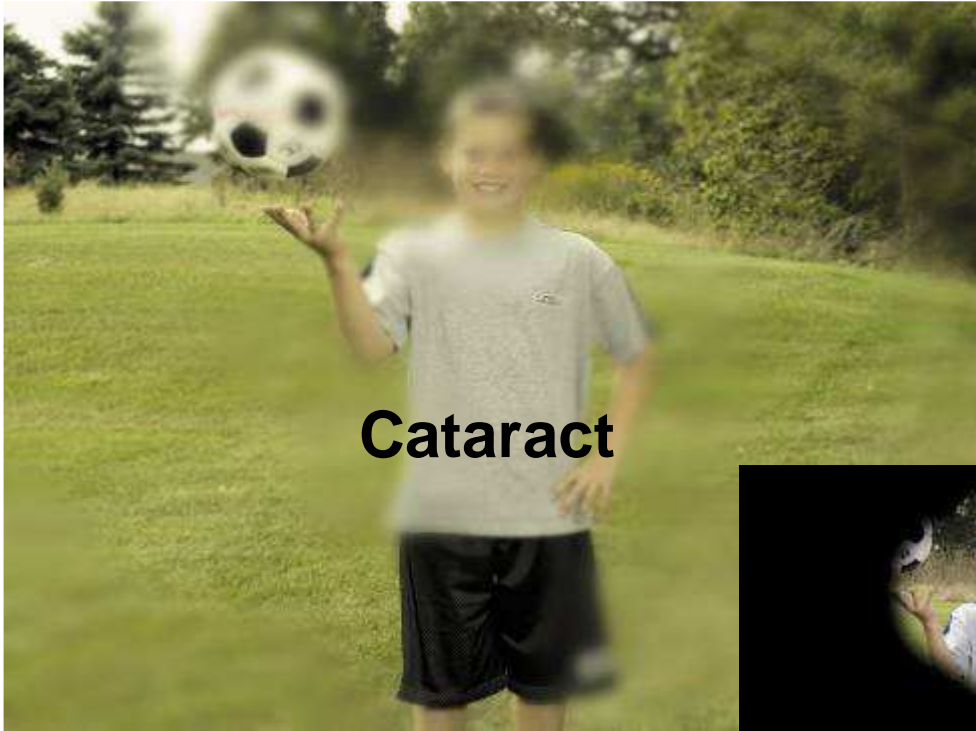
## 3) **Age related macular degeneration** - 11% in 65-74 years frequent causes of senior blindness (Topinková, 2005)

## 4) **Other**

**Vision - Cognition - Speed**







**Cataract**



**Glaucoma**



**Retinitis Pigmentosa**

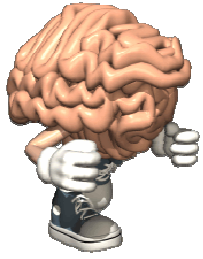


**Diabetic Retinopathy**

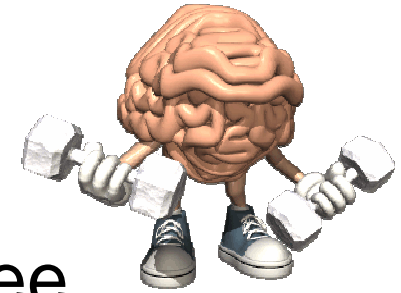




**Age-Rel. Macular Degen.**

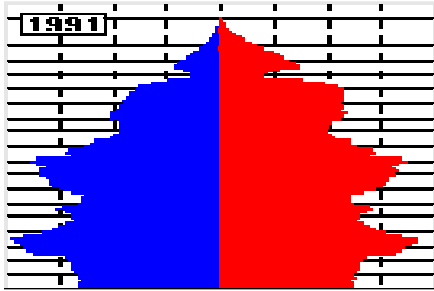
<http://www.lowvisionclub.com/articles/seewhatisee.html>



# Cognitive skills



- 1) Drop of vigilance, Looked-but-failed-to-see + experienced drivers, + another car present (Herslund, 2003) 
- 2) 37% of collisions - no one realized / in time - speed 27% drivers, 24% cyclist tried to advert the accident (Räsänen, 1998)
- 3) Unjustified expectations about the behaviour of others 
- 4) Alcohol, Medicaments, Drugs, Genetics
- 5) Health conditions (dehydration, hypoglycaemia, hypothyreosis, neurological, cardiovascular and blood disorders, dementias, etc.)



# Seniors X Speed



- 1) **Crashes:** - rear-end and ran-off-road  
+ failed to see / detect the other vehicle  
+ right-of-way crashes, - assessment of adequate time to proceed
- 2) **Medicaments:** 89% in 65-74 years  
tricyclic AD, barbiturates, diazepam, chlorthalidone, reserpine, methyldopa, levodopa, bromocriptin, pentazocin, meperidine, indometacin, propranolol, disopyramide, metoclopramide, spasmolytics, antipsychotics, anodynes, antihistaminics, H-2 blockers, theophyllin, some antibiotics, digoxin
- 3) **Dementia:** 3-7% population 65 years +
- 4) **Fatality of TBI:** 20% in children, 71% in 75years + (Javouhey, 1969)  
↑ fragility - bone & brain , ↓homoeostasis, ↓hypoxia tolerance, ↑ extend of brain injury, ↑ intracerebral bleeding
- 5) **Falls** = leading cause of TBI 4 years -, 75 years+ (NCIPC, 2007)  
20-30% of the seniors aged 65-69  
50% of seniors above 85 years sustain an injury / 1 year  
because of a fall (osteoporotic fracture, traumatic brain injury etc.)  
(Topinková, 2005)



# Bicycling injury

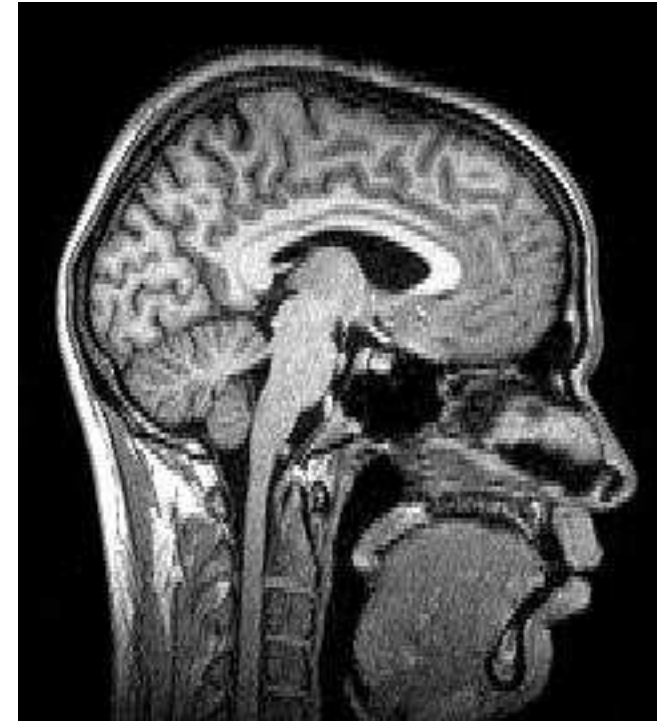
- 1) 16m/s (57,6 km/h) - 50% risk of death
- 2) Head trauma hospitalised bicyclists are 20 times more likely to die (Haileyesus, 2007) and represent almost 100% (Mraček, 2004), 90% (Soori, 2002), 80% (Henderson, 1995), 75% (Frič, 2007) of cycling fatalities
- 3) Fractures
- 4) Injury of soft tissues





# Traumatic brain injury (TBI)

- 1) Brain contusion
- 2) Diffuse axonal injury- DAI
- 3) Intracranial bleeding
  - Epidural haematoma
  - Subdural haemorrhage
  - Subarachnoidal bleeding
  - Intracerebral bleeding
- 4) Consequences of head injury



# Brain contusion – few points

1) **Sympathic activation** - hearth arrhythmias ! (seniors after IM, WPW syndrome etc.)

2) **EEG  $\Delta$  in retic. form.** (activating upper mid brain)  $\leftarrow$  rotation

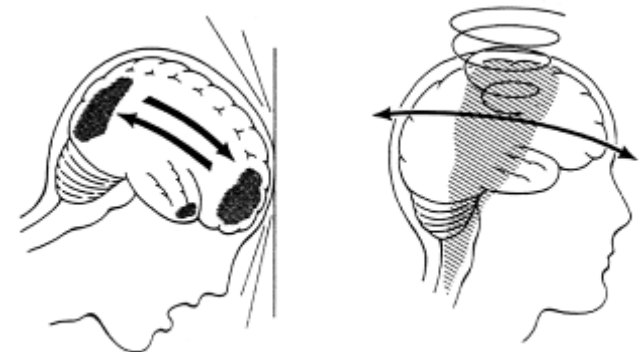
3) **ATP depletion + X haematoenc. barrier**  $\rightarrow$  + neuronal death  
oxidation stress  $\rightarrow$  x mitochondrial DNA  $\rightarrow$  - ATP reserve:



senior age,  $\downarrow$  lung, heart, blood functions  $\rightarrow$  mild hypoxia,  
infections, alcoholism, smoking, X-ray th., chemotherapy,  
resuscitation, sepsis, intoxications, MTCH inborn mutations



4) **Microbleedings, bleedings**

5) **Predispositions** to Alzheimer and other neuropsychiatric disorders





# Spontaneous brain haemorrhage:

- 1) **↑BP:** metabolic, cocaine, amphetamines, atrial fibrillation, ↑Na
- 2) **Art. degener.:** amyloidal, atherosclerosis, macro- and microangiopathias, ↑cholesterolemia, obesity, etc. 
- 3) **X collagen:** Ehlers-Dunlos syndrome, osteogenesis imperfecta, aneurysms, glucocorticoids, ↓vitamin C, ↓ protein, chemotherapy, actinotherapy
- 4) **Genetics:** brain haemorrhage in the relatives
- 5) **Inflamation:** acute inf., brain infec., syphilis, autoimm. dis.
- 6) **Thrombocytopenia:** acute HIV, hep. C (Karibe, 2001), autoimmunity, chinine, sulphonamides, heparins, cytostatics, salts of gold, diclofenac, sulfathiazole, co-trimoxazol, vancomicine, piperacilin, prokainamid, methyldopa, thiazid diuretics, carbamazepine, ranitidine, estrogens, danazol, etc.
- 7) **↓Prothrombine:** surgery, ↓ vitamin K, antibiotics, cumarine derivates, acetylsalicylates, heparins, ticlopidine, IIb/IIa inhibitors
- 8) **Others:** ↓ function of thrombocytes, haemophilias, Smoking (3 h !) (Kalita, 2006), hypoxia (lung or hearth diseases), ↓B12, dehydration, alcohol 



# Intracranial bleeding



- 1) **Subdural haemorrhage** - whiplash mechanism  
seniors - vessel fragility, degeneration, dehydration, brain atrophy, anticoagulant therapy, etc.  
Acute / Subacute (weeks) / Chronic (20-30% recall no head injury)
- 2) **Subarachnoidal bleeding (SAH)** - head deceleration  
hypertension, smoking, family history (4% risk), age 40 – 60, women (60%), African Americans, Aneurysm rupture risk—size, smoking, alcohol (Anderson, 2007), Wider subarachnoidal space - children (constitutional), seniors (dehydration, brain atrophy)
- 3) **Intracerebral bleeding** – rotational acceleration of the hemispheres - basal ganglia and surrounding structures - seniors (vascular amyloidosis), impaired blood coagulation  
Fatal bleeding can occur even several days after the injury

# Children



1) EU 15-24% < 18 years

59% bicycle fatalities < 20 years (Cooke, 1993)

2) BRAIN: - speed assessment, - protective reflexes  
+ evaluation mistakes, + reacting times

3) BRAIN INJURY:

+ skull elastic deformation, + diffuse injury

+ subarachnoidal space

- limit of ICP (10 mm Hg compared to 15mmHg)

+ risk of coagulopathy

+ early post-traumatic seizures

# TBI minimal consequences



- 1) **TBI - frontal lobes !** - development < 16 years → may not manifest until later
- 2) **executive functions**, interpersonal skills, ↓ spontaneity in interacting with others, ↓ higher learning level, ↓ attention, fatigue, ↓ planning, ↓ problem solving, ↓ daily decisions, ↓ initiative, ↓ flexibility, ↑ impulsiveness, ↑ irritability, ↑ temper tantrums, ↑ opposition, ↑ persistence of a single thought, saying socially inappropriate things
- 3) ↑ **difficulty in socialization** is associated with ↑ addictions to drugs and alcohol, ↑ risk of major depression, bipolar affective disorder, generalized anxiety disorder, borderline and avoidant personality disorders.
- 4) **Normal /+ IQ after injury still can have profound problems !**
- 5) **TBI < 7years** - less likely recovery of IQ scores, ↑ impact on "fluid" intelligence skills



# Injury of soft tissues



- 1) **Thrombosis** -7% of the EU pop. - Leiden mutation
- 2) **Infection:** Pneumonia without injury - 15% mortality > 65 years , ≤ 90% of all senior deaths (Topinková, 2005).  
Imunosupression, sinusitis, open head injury, genetics
- 3) **Pneumothorax spontaneous:** asthma, COPD, smoking, chronic cough, alpha 1 antitripsin deficiency and emphysema (genetic predispositions)
- 4) **Hollow organs:** full urinary bladder, gastro-duodenal ulcers, diverticulosis
- 5) **Healing of wounds:** tetanus vaccination, disinfection, hydrocolloids, blood circulation, immunity system support, cell proliferation, collagen production and antioxidant capacity - vitamin C, E, A, zinc, glutathione, proteins etc.

## Fractures

**Lower skeleton resistance** (women and elderly, risk factors of osteopenia) → ↑ injuries to internal organs and nerves, crash with a fixed object → ↑ risk of dying

- 1) **Injury of the spine and spinal cord**
- 2) **Femoral neck fractures** - binding-type pedals



# Conclusions



# Separation



- 1) Motor vehicle accidents with involvement of cyclists = the most serious cycling collisions and the biggest reason why people are afraid to use a bicycle
- 2) **Population is getting older = more visual and cognitive problems in traffic in the future, ↑ fatality**
- 3) Need for improved road and city planning to separate bicyclists from motor vehicles.



# Necessity of being seen in time

- 1) **Population is getting older**
- 2) **Vision and cognitive impairments**
- 3) **More time for driver to react:**
  - 1) **speed limits**
  - 2) using **lights** and **reflexive materials**
  - 3) **never expect** proper behaviour from others
- 4) **Reflexive material** – 3x ↑ distance than white clothes, 10x ↑ than dark clothes in the night
- 5) **Light** ≤ 200m. Intermittent red light better effect in attracting driver's attention, even during daylight within rush hours







# Helmets

1) **No helmet protect against impact with a motor vehicle on the road!**

2) **↓ TBI**, even during the impact with motor vehicle, is of **↑↑↑ significance**

3) Helmet → **↓ TBI risk 40 - 85 %**

4) **Safe helmet construction** - X rotational accelerations



**Helmet shell** - as smooth as possible and hard, with fewer openings, round, symmetric, well fixed and fitting on the head (Andersson, 1993; Hansen, 2003), fibre-reinforced plastic (FRP) - energy absorption - ↑ inner shell deformation

**Padding materials** - plastic (Beusenbergh, 1995)

5) **Helmet use** ↓↓↓: 11 -19 years (31%) and 30 - 39 years (30%)

"uncomfortable", "annoying", "it's hot", "don't need it" and "don't own one" significantly influence - peer helmet use, parents and friends (Finnoff, 2001; Gielen, 1994; Sissons, 1994) ↑↑↑: cities, > 50 years (Finnoff, 2001), higher education, better socio-economic status (Macknin, 1994)

6) **Lack of public education**

# Thank You for Your attention



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