IMPULSE CONTROL DISORDERS : The Neurobiology of Pathological Gambling

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This talk will cover:

- Historical look at gambling
- Definitions
- Clinical presentation
- Categorization
- Prevalence in UK
- Comorbidity
- Neurobiology of PG in adolescents and adults: neurotransmitters, neuropsychological testing, neuroimaging and white matter abnormalities.

THE GAMBLING MAN SONG

One day it's milk and honey

Next day hustling round for money

Ev'ry gamblin man he knows,

Easy comes and easy goes

One day you are one great big winner

Next day you haven't got your dinner

And when you die ,there's few will sigh, for a gambling man

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IMPULSE CONTROL DISORDERS

- Pathological Gambling
- Kleptomania Binge Eating
- Trichotillomania Internet Addiction
- Pyromania Compulsive Buying
- Intermittent Explosive Disorder
- Pathological Skin Picking
- Compulsive Buying Self Injurious Behaviour

HISTORICAL LOOK AT GAMBLING

- 2000 BC Egyptians used painted knucklebones as dice.
- 1500 BC First roulette game
- 210 AD First horse race took place in England
- 1588 First lottery (in England as Queen Elizabeth needed the money!)

EGYPTIAN DICE

DEFINITIONS

GAMBLING- The process of placing something of value (usually money) at risk in the hope of gaining something of greater value.

Marc Potenza- Yale

Definitions:

- PATHOLOGICAL GAMBLING (PG)

A PERSISTENT AND RECURRENT MALADAPTIVE GAMBLING BEHAVIOUR THAT DISRUPTS PERSONAL FAMILY OR VOCATIONAL PURSUITS.

PG often starts with a PREOCCUPATION with gambling and a need to gamble increasing amounts.

WHAT DO WE KNOW ABOUT PROBLEM GAMBLERS?

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ONSET

- The earlier the onset of gambling activity in childhood, the more likely a person is to develop a gambling problem.

PGs generally report starting gambling between the ages of 8 and 11 years.

Regular gamblers who do not present PG profile tend to have started later, btw 11-13.

PRESENTATION

- PGs often experience RESTLESSNESS or IRRITABILITY when they cut down or stop gambling.
- Gambling often used to escape dysphoric states and psychological discomfort.
- After losing money, PGs tend to CHASE LOSSES to win the money back.

PRESENTATION

- PGs frequently lie to family members and therapists to CONCEAL the extent of their gambling.
- Most gambling begins within the FAMILY and AT HOME.
- In one study 50% of children of PGs were PGs themselves.(H.Lessieur et al 1988)
- Children of PGs have higher rates of depression and substance misuse

PRESENTATION

- Most PGs report changes over time in their MOTIVATION for gambling, with less importance over time given to winning and more importance to the PROCESS OF GAMBLING.
- PG has a chronic progressive course with periods of abstinence and relapse.

ICD 10 PG F63

- HABIT AND IMPULSE DISORDER.
- Essential feature is the persistently repeated gambling which continues and often increases despite adverse social consequences such as impoverishment, impaired family relationships etc

DSM IV

- Impulse control disorder category since 1980

CRITERIA:

Preoccupation with gambling

Tolerance (higher bets as time goes on)

Loss of Control (person can not stop the behaviour)

Withdrawal (psychological discomfort)

Escape (from life's responsibilities)

Chasing Losses

DSM IV

- Deceit
- Illegal acts (to fund habit)
- Relationships
- Financial bailout- friends/family

- Questionnaire scores yes or no in MONTH prior to interview. Yes to 3 =problem gambler. Yes to 5 = PG

Gambling is a popular recreational activity in the UK…

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British Gambling Prevalence Survey 2010

- 73% of the adult population have gambled in the last year (including lottery)= 35.5 million people.
- Prevalence of PG in UK is 0.9= 451,000
- (in 2007 it was 0.6 = 350,000)
- In UK, fruit machines (category D) are legal for children to play on. They are in pubs and amusement arcades.
- PGs are more likely to be male, of younger age, and have parents who gambled regularly or were problem gamblers.

PG and DRUG DEPENDENCE

- Shared criteria:
- Tolerance
- Withdrawal
- Repeated unsuccessful attempts to cut back or stop
- Interference in personal, professional and social aspects of life.

PG and DD

- Similarities between the two extend to:
- phenomenological
- Epidemiological
- Clinical
- Genetic
- Neurobiological

areas.

MAJOR CO-MORBID CONDITIONS WITH PATHOLOGICAL GAMBLING

- ALCOHOL MISUSE
- DRUG MISUSE
- DEPRESSIVE DISORDERS
- BIPOLAR-AFFECTIVE DISORDERS
- PERSONALITY DISORDERS

GAMBLING AND SUBSTANCE MISUSE

- Over 50% of PGs had a substance misuse disorder compared to < 20% of non-gamblers (Bland et al 1993)
- BI-DIRECTIONALITY

Feigelman 1998 showed that among subjects with a substance misuse disorder (n=412) 20% also had a gambling problem.

SUBSTANCE MISUSE

- Bland 1993 found that the prevalence of illicit drug use and dependence was 4 times higher in PGs than in non-gamblers.
- Is it all due to an underlying neuronal predisposition towards addictive behaviour which encompasses both substances and gambling OR is taking drugs more acceptable among certain populations eg gamblers?

ALCOHOL

- Strong association between alcohol and gambling disorders.
- Rates of alcohol misuse or dependence are at least 4 times higher in individuals with a gambling disorder compared with those without a gambling disorder. (Bland 1993, Cunningham-Williams 1998, Smart 1996)

YOUNG PEOPLE AND PG

- International studies: 60-80% of 13-17 yr olds report having gambled for money in the past year (Derevensky et al , Shaffer et al,Delfabbro et al)
- 4-8% of adolescents are thought to be problem or pathological gamblers (Gupta et al)
- However, young people tend not to seek help,what are the barriers preventing them?.

UK Stats- Young People

- In UK: 2%(=60,000 children) of 12-15 year olds are problem gamblers (double the adult rate) (2008-9 British Survey of Children and Gambling)
- In UK 21% of children had gambled in past 7 days.
- 0.9 % of 16-24 year olds are PGs, (= 67,500 young people)

PG IN ADOLESCENTS

Linked to:

- criminal behaviour
- Alcohol and drugs misuse and dependency
- Disrupted family and peer relationships
- Poor academic performance

ADOLESCENT PGs (Int centre for youth gambling)

- Are at greater risk of suicide and suicide attempts
- Often replace their friends with gambling peers
- Have poor general coping skills
- Start gambling around 8-10 yrs
- Report more major traumatic life events
- Often have family who gamble

ADOLESCENT BRAINS

- As adolescent brains mature, they gradually become able to a greater or lesser extent to resist impulses and to make advantageous choices by disregarding immediate rewards in favour of long-term greater gains.
- The Ventro-medial prefrontal cortex is a key area in this process.

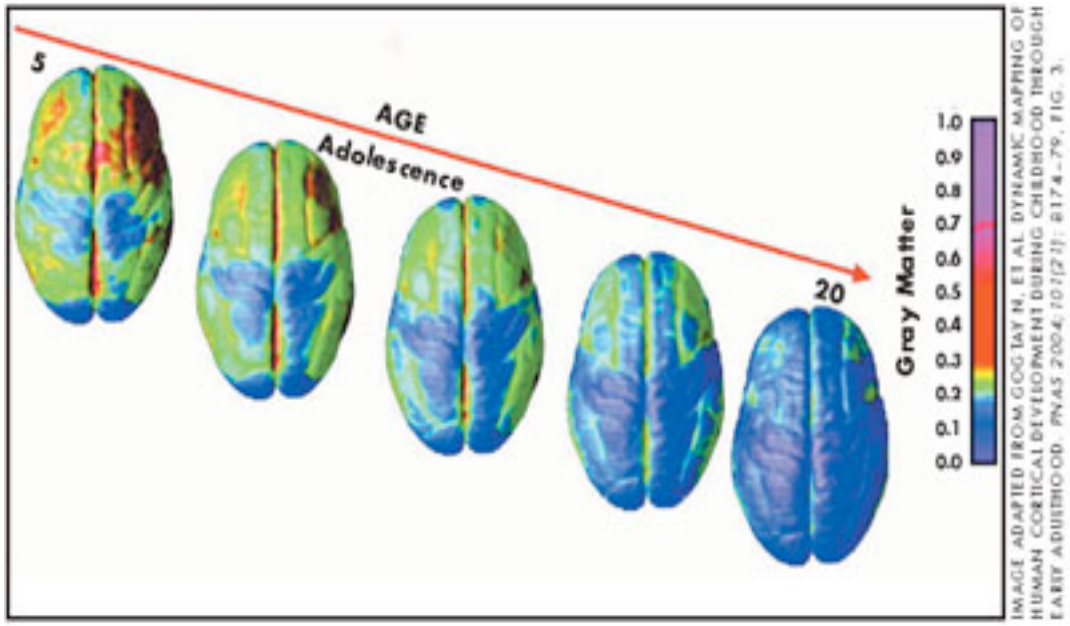
ADOLESCENT BRAINS

- High risk taking behaviour
- Sensation-seeking behaviour
- Emotional volatility
- Greater autonomic and neuroendocrine reactivity to stress
- Increased cognitive disruption during stress are all factors that will impact on the higher % of PGs in young people.

ADOLESCENT BRAINS

- The maturation of the brain in its ratio of white matter to grey matter takes place from back to front (more white matter in adults as brain more myelinated), therefore the prefrontal cortex is the last to mature, making risk-taking behaviour and increased sensation seeking typical of adolescent.

Grey matter loss and myelination



NEUROTRANSMITTERS AND PG

- NORADRENALINE-linked to arousal and excitement.
- Higher levels of noradrenaline found in urine, blood and cerebrospinal fluid of PGs.(Roy et al 88)
- Noradrenergic activity influences prefrontal cortical function and posterior attention networks.

SEROTONIN

Linked to behavioural initiation and cessation.

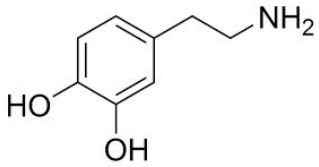
- People with ICD have lower levels of the serotonin metabolite 5 HIA (5-hydroxy indoleacetic acid.)
- Also, individuals with ICD display different behavioral and biochemical responses to serotonergic drugs compared to controls.: PGs reported a ‘high’ following m-CPP

SEROTONIN

- M-CPP (meta- chlorophenylpiperazine) and is a partial serotonin agonist that binds to multiple 5HT1 and 5HT2 receptors.
- This ‘high’ was not reported in normal controls but was identical to the response of alcoholics to m-CPP.

PGs also had a higher Prolactin response to m-CPP than controls .

DOPAMINE



- Linked to rewarding and reinforcing behaviours.

- One early molecular genetic study on PG implicated the TaqA1 allele of the dopamine receptor gene DRD2 in PG, substance disorders and some psychiatric conditions (Comings 1998)
- Findings have not been successfully replicated.

DOPAMINE

- Dopamine (esp D2 and D3) agonists used to treat Parkinson's Disease such as Pramipexole and Ropinirole have been found to cause the onset of ICDs, including PG even in people who had never gambled prior to developing PD.
- Also compulsive shopping and compulsive sexual activity. Not necessarily all in the same patient!

OPIOIDS

- This system regulates the mesocortical limbic system which modulates reward.
- One study (Shinohara 1999) found elevated rates of beta-endorphin , the endogenous mu-opioid receptor agonist , in habitual players of Patchinko in Japan.
- These endorphins peak during winning periods.

OPIOID antagonists

Placebo- controlled, double blind randomized trials have evaluated the efficacy of Naltrexone and found it superior to placebo in the treatment of PGs. (Kim et al 2001). It is the most validated pharmacological intervention for PGs.

- Namalfene (opioid antagonist) was also found to be effective and less likely to cause liver impairment. (Grant 2006) Effective in PGs at at lower dose of 25-50 mg OD as much as higher dose of 80-100mg.
- We will be trialling both of these medications at the NPGC.
-

GLUTAMATE

- Involved in motivational processes.

Glutamatergic modulating agent N-acetyl cysteine was used to treat PGs with significantly positive result. (Grant 2007)

NEURAL SYSTEMS

- Early fMRI study (Potenza 2003) showed less blood oxygen level-dependent (BOLD) signal changes in frontal cortical, basal ganglia and thalamic brain regions of PGs watching images of gambling compared to regular gamblers.
- Especially low signals in VENTROMEDIAL PFC, several studies have replicated these findings.
- Inverse correlation found with severity of PG (Reuter 2005)

NEUROBIOLOGY OF PG

- If PG is to be conceptualized as an addiction without a drug, a NATURAL or BEHAVIOURAL ADDICTION, then its study may provide insight into the core neurobiology of addiction and guide us to effective treatment.
- Risky decision-making….VMPFC
- Placing higher wagers on simple probability decisions
- Less likely to choose delayed rewards over immediate gratification
- Problems in learning advantageous tactics for future rewards.

NEUROBIOLOGY

- The VM PFC is associated with immediate reward gratification and impaired functioning in this area is linked to the inability to postpone gratification by choosing a greater reward at a later time rather than a smaller one immediately.
- Ventral striatum under-activation in PGs is consistent with results in other addictions such as alcohol or cocaine.

WHITE MATTER ABNORMALITIES

- In substance misuse brain white matter integrity abnormalities have been shown.
- In 2011 MRI first studies of the brain of PGs showed:
- No volumetric differences in grey or white matter between PGs and controls.
- However, abnormal white matter in corpus callosum and superior longitudinal fasciculum was similar to substance misuse findings.
- Is this a consequence of the addiction or a predisposing marker? More research is needed.

NATIONAL PROBLEM GAMBLING CLINIC

I started it in 2008

Now about 1200 patients including carers

Multidisciplinary team including FT and MM

Great outcomes- see next lecture by NS.

Problem Gambling Research Consortium- possibilities for joining the group.

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